AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS, AND BLACKSMITHS.

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New Radial Drilling Machine.

The machine illustrated herewith has a quarter-circle base, of unusual size, for the accommodation of large work. The outside pillar or support is moved around the circle by means of rack and pinion, in a way clearly shown in the engraving; this pillar can, when required, be bolted rigidly to the base, or it can be removed to admit work otherwise too large to be admitted under the spindle.

The arm has a bearing on the main column 32 inches in length, and is strongly ribbed on the top. The spindle frame is moved along by means of a crank, which enables the operator to stand at the spindle while bringing it to the desired position.

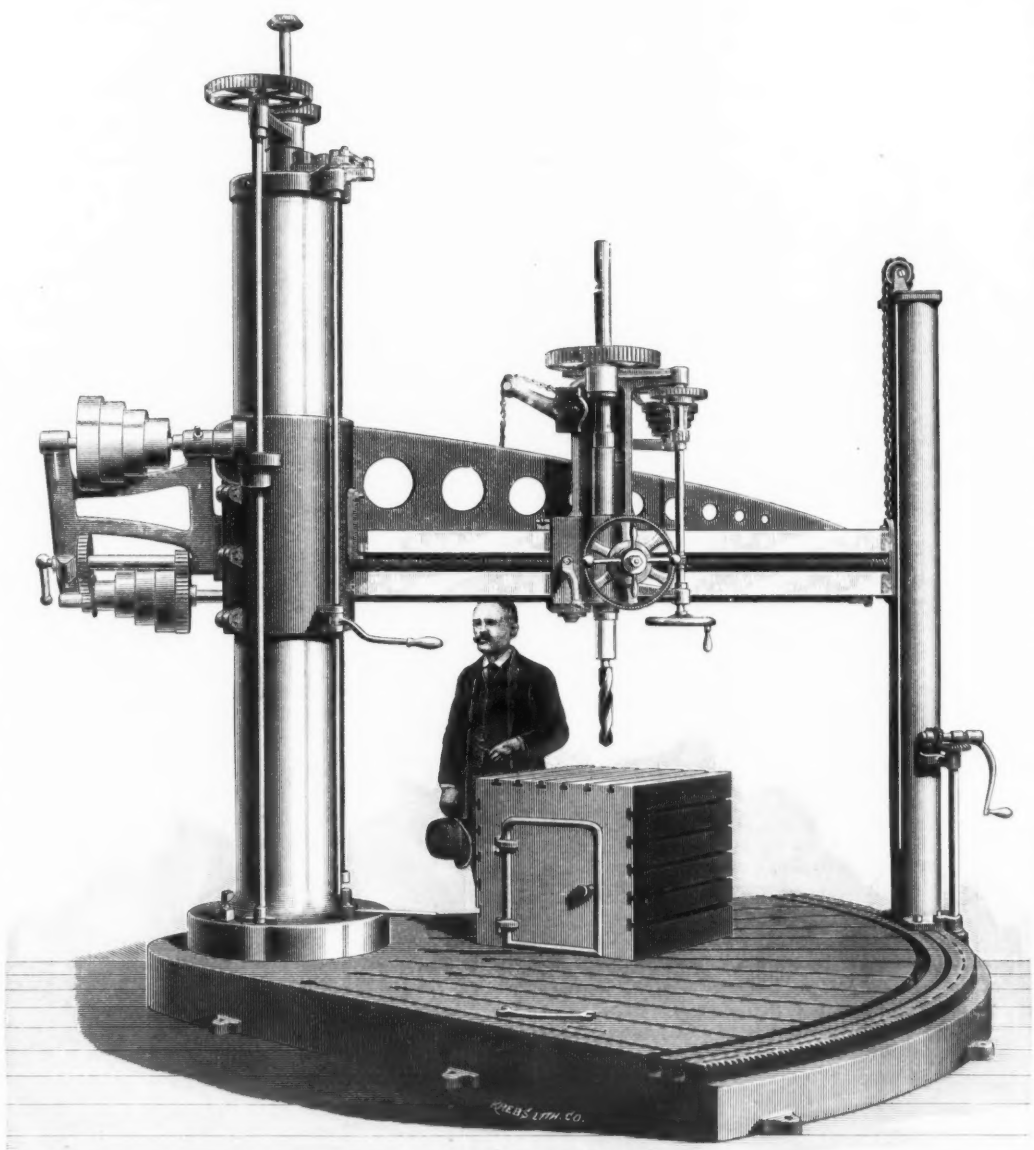
The column which carries the arm, driving gear, frame, etc., is bored and fitted over a stationary stump, bolted fast to the sole plate; this stump has sufficient length of bearing to prevent column from swaying, and is provided with an adjustable pivot bearing upon an elastic diaphragm in the column, which, when the bolts in the flange at the lower end of column are slackened, takes the weight of the machine off the flange bearing, and allows the column with arm, etc., to revolve easily the entire circle. For ordinary drilling the bolts in flange need not be tightened, but when extraordinary rigidity is required a partial turn of the wrench will bind the column fast to the sole plate. The sleeve which carries the arm and gear frame is fitted snugly to the column and may be raised and lowered by power, and is provided with clamping bolts. The table has both horizontal and vertical faces, and is provided with T slots, all planed.

The counter-shaft consists of a frame with horizontal shaft and T and L pulleys, and a pair of cut miter gears to connect with vertical shaft at center of top of column. The spindle, feed screw, elevating screw and all shafts are made of machinery steel, and the feed worm is made of the best tool steel and hardened; all thrust bearings are provided with phosphor bronze washers.

The machine illustrated has a column 15 inches diameter and 9½ feet in height. The radius of arm is 8 feet, giving a possible distance of 6 feet 10 inches from base to end of spindle. The greatest distance from floor to end of spindle is 7½ feet. The total height of machine exclusive of countershaft is 11 feet 5 inches, or including countershaft, 13 feet. The height of table from base is 25 inches, the top of table being 28 inches square. The table has planed T slots on the top and on two sides.

The spindle is 2½ inches diameter, with hole "Morse taper." The traverse of spindle is 20 inches. The weight of this machine is about 15,000 pounds.

This machine is manufactured by the Universal Radial Drill Company, Cincinnati, Ohio.



NEW RADIAL DRILLING MACHINE.

Starting a Machine Shop.

BY C. W. CRAWFORD.

Nearly every machinist has an ambition to become a foreman or proprietor of a machine shop of some kind. It is much easier to succeed in the former than the latter capacity, but to be a successful proprietor a man ought to have some experience as foreman. Most shops are established for some particular kind of work, generally local work, specialties being taken up afterward. This is probably the best plan, because if a shop can hold its own, or make money on local trade, it is safer to risk special work after having some experience. The amount of capital required need not be large, and can be saved in a few years if a man has only the will to do it. It is generally safe to follow the advice of Horace Greeley, and go West. There are plenty of towns yet wanting machine shops. In choosing a location it is proper to ask the citizens to donate a site and building; very few towns will refuse this request. It is best to build a brick shop, and design it so as to build on afterward. If located in a small country town few tools will be required at first, depending on the surroundings. A 36″ and 20″ lathes of good make, a 30″x30″x8′ planer, a 36″ back-geared, self-feed drill and a small drill, a pattern-maker's lathe, a lot of machinists' small tools and tool grinder, an engine and boiler, line shaft and pulleys, etc., will be good outfit. In addition, a face-plate lathe will be needed. This tool can be made cheaper than it can be bought, consisting, according to Chordal, of a few gears and pulleys, a belt, and a hole in the ground, a set of blacksmith tools and forge, and a foundry outfit consisting of a cupola made of the shell of a 42″ boiler, a few ladles, flasks and some sand completes the layout. The head of such a shop must be a machinist, a good workman, and a man of indomitable will and perseverance, and its success will depend on his energy, integrity and financial ability. Very few machinists combine all of these qualities in addition to their mechanical ability, and hence more fail than succeed. The man who runs a provincial shop must be full of expedients and equal to every emergency. He will be called upon to produce the most unheard of machinery. Whatever the class of work, he must do good work, and he must do it according to promise. A safe rule to begin with is, never indorse for any one and never ask for indorsement. Buy at headquarters, and for cash if possible. Allow your creditor to draw on you through the bank. You will probably get longer time by doing so. Never return a draft—hold it and pay as soon as you can. Use brains in designing new machines. Adopt old styles if simpler, rather than new ones that are complex. Use plenty of iron—too much is just right. Treat all customers alike, even your worst enemy, and the man who parleys half a day and goes away without ordering anything you may get later. Hire only good workmen. Think a couple of times before hiring a discharged man back again; he will get even with you or ahead. Pay higher wages than other shops; you can afford it. Never allow a man to be dissatisfied with his pay. Keep a limited number of apprentices and teach them everything in the shop, and when in need of a foreman make one of an apprentice rather than a stranger. The writer once said to an apprentice, "Young man, do your best, you don't know what may happen here in ten years, you may be at the head of this shop." That boy is now foreman of the shop, and is a success. Paddle your own canoe if possible, but an agreeable partner is desirable. Two are company, but, bear in mind, three are a riot. A partner must not be of the same trade as yourself, or better, no mechanic at all, but a good office man, who can also talk machinery.

Locate where there is a good local trade, but work up a shipping trade as soon as possible. This is what builds up a town; local trade is simply swapping dollars, as far as profit to that locality is concerned. Avoid strikes by discharging all chronic agitators. Good men can always be kept at work by paying good wages. Invest your money in extending your business, and after fifty years of age, let your foreman run the shop and make yourself comfortable.

Massachusetts Institute of Technology.

We are in receipt of the Twenty-Second Annual Catalogue of the Massachusetts Institute of Technology, of Boston. It contains a list of the officers and students, and a statement of the courses of instruction: also a list of the Alumni. It is a book of more than 160 pages; giving very complete information regarding the workings of the Institute. The foundation of the Institute, and its subsequent growth are matters that will be found interesting reading. The following in relation to mechanical engineering, which we copy from the catalogue, will show the scope of the school in this direction:

The course aims to equip the student with

such training in pure and applied mathematics as shall qualify him to deal with the engineering problems of his profession from the most favorable standpoint. It attempts by instruction, both theoretical and practical, to acquaint him with engineering practice, and to give him a proper groundwork upon which to base a professional career. The more strictly professional work of the course may be classified as follows:

1. Mathematics, physics, and applied mechanics, given outside the departmen ; the last including the study of, and practice in testing the strength of materials.

2. Recitation-room work of the department proper, beginning with a study of the principles of mechanism, the construction of gear-teeth, etc., and continued by courses on machine tools and cotton machinery. Courses are given on the slide-valve and link, thermodynamics, theory of the steam engine, and on steam boilers. The fourth year instruction includes such mechanical engineering subjects as dynamometers, governors, fly wheels, springs, relative effect of reciprocating parts, balancing of engines, injectors, steam-pumps, cylinder condensation, hydraulics and hydraulic motors, etc. An option is given among courses on marine engineering, locomotive construction, and mill engineering.

3. Drawing-room work. The students in the second year make work-drawings from measurements, and the drawings necessary in connection with the course in mechanism and gear construction. In the third year they make detail and assembly drawings from machinery, and this is followed by mechanism designs, and boiler drawings. In the fourth year a course in machine designs is given.

4. Shop-work, including carpentry, pattern-making forging, chipping, filing, and machine-tool work.

5. Mechanical engineering laboratory work. This begins with drill in steam-engine tests in the second terms of the third year, and is continued throughout the fourth year, including tests of boilers, pumps, power, etc., and a large amount of investiga ion.

Following this the course of studies are given in detail; they seem to us to be very complete.

The course in civil engineering, mining engineering, electrical engineering, chemistry, &c., &c, are equally well explained. We should say that the catalogue would be instructive to any student in the direction of applied science.

Condition and Prospects of the Machinery Business.

LETTERS FROM PROMINENT ESTABLISHMENTS TO THE "AMERICAN MACHINIST."

Hewes & Phillips Iron Works (Steam Engines, Boilers and Machinists' Tools), Newark, N. J., write us:

The volume of business transacted by us during the year 1886 has been unusually large, showing a decided improvement over that of the year 1885. Prices received for our products have, however, been very unsatisfactory, but we are happy to report that they are materially improving and with a prospect of a still further advance. During the past year we have put in a large number of new tools, and improved our equipment and organization in every department. The growth of our Corliss engine business has been of the most satisfactory character, having built about 50 during the year 1886, ranging in sizes from 50 up to 400 horse-power.

We now have in course of construction engines for the following parties: One 250 horse-power Corliss engine, for Newark Electric Light and Power Co.; one 150 horse-power, for Sohmer & Co., piano manufacturers, of New York; one 75 horse-power, for Claus Lipsius Brewery, Brooklyn; one 60 horse-power, New York Preservative Co.; one 60 horse-power, Judge Addison Brown; and two, of 250 and 200 horse-power respectively, for Atchison, Topeka and Santa Fe Railroad; also several others for different sections of the country. We are also executing a large order for planers, shapers and slotters for the above railroad; also constructing a fine plant of ten Otis steel boilers, of 120 horse-power each, for the Clark Mile End Spool Cotton Co. The above contracts, together with a large amount of other miscellaneous work, make us extremely busy, and we are now running nights. The prospects for the year 1887 are most flattering, and we look for a large and profitable business.

The National Water Tube Boiler Company, New Brunswick N. J., write us:

We are much gratified, in looking over our business of the past year, to note its growth and extent.

We have had a large increase over that of the previous year, and, with the present indications, we expect to double the number of orders we have filled, during the coming year.

We find that steam users are appreciating the superior points of water tube boilers, and are expressing their appreciation in the very practical way of giving us the preference, when placed on an equal footing with other manufacturers of the same class of boilers. This, of course, has encouraged us to constantly increase our facilities for manufacture, and to maintain the high standard of workmanship and material with which we originally started out in the manufacture of these boilers. We are therefore in a position to look forward with great encouragement to the coming year, and expect to be able to make a still better report at the close of 1887.

Coffin & Leighton (Machinists' Steel Scales), Syracuse, N. Y., write us:

Our trade for 1886, our first year, has been good. Our scales are giving complete satisfaction. The prospects for the coming year are very favorable.

W. P. Davis, (Machine Tools), North Bloomfield, N. Y., writes us:

Business for 1886 has been quite satisfactory with me; while we have not d ne a large busine s I can see we are steadily gaining ground as we become better known, and we see a decided change for the better in the past two months, and think we have every reason to look for quite an increase of business in the spring. We have had quite a limited export trade this season, but could not look for much as we have not advertised abroad the past year. We are just finishing a lot of one hundred and twelve machines, which we have made in one lot, 56 being our 20-inch drill on which we are having a fine trade. We are just finishing a new grinding machine for grinding long strips of steel, and bringing them square and true, the machine working automatic. We have made some improvements this year by putting in new machinery, etc. We now heat our machine shop and foundry by exhaust steam pipes overhead, and it works well. Have also just finished our new office building which is separate from the main buildings, and find it much better in every respect, not only being clean but free from any jar whatever. It is also light. From past experience we think any one will find it a much better way when it is possible to have office separate from main building. We have turned our old office into a tool room, which makes a very satisfactory addition to our machine room. We continue to use natural gas, and it is very satisfactory, both for fuel and lights. We have run full time the past year and have had no trouble with help in any way, and believe much of the labor trouble might be avoided were the employers more ready to look after the interests of their employees before they had reason to complain. When they know you look out for their interests they do not watch them so closely themselves.

The Ferracute Machine Company (Presses, Dies and Sheet Metal Tools), Bridgeton, N. J., write us:

We notice that you are publishing in your paper reports from the various manufacturers all over the country, and thought you might like to insert something concerning our business.

The first part of the year was unusually dull, with small sales and at very low prices. During the last two months, however, it has increased considerably, and we are now very busy, running a full force of about 80 men, and there are several thousand dollars worth of orders ahead, with good prospects of a still greater increase. We have improved many of our old style presses, and during the year have added a complete new line of punching presses with gearing, and another line without gearing for a heavier line of goods such as nuts and washers, hardware, railroad and bridge work, and general machine shop use. These have proved quite popular, and a large number of them have already been sold among many of the prominent manufacturers of the country. We have also added several new special foot and power presses, and our catalogue now describes over one hundred different sizes and kinds.

We have put in during the year considerable improved machinery, and are now manufacturing most of our presses on the "duplicate system," making up our parts in large quantities, which enables us to make considerable decrease in their cost. We have divided our shops into two departments, one for presses and other large machines, and the other for our dies and small tools. We have added somewhat to our buildings, and are carrying a considerably larger stock of finished goods than ever before. We have placed (for the convenience of our customers) a number of machines on exhibition in a New York store.

We have felt but little inconvenience from the labor troubles, and have kept matters running smoothly by some small increase in our wages.

Our orders at present are from all parts of the world, some of our recent shipments being to Germany, Australia, New Zealand, etc., and we think there is a prospect of our foreign trade increasing.

L. S. Starrett (Fine Tools for Machinists), Athol, Mass., writes us:

We have been so busy moving and getting settled in our new shop that we have had little time to answer your inquiry relating to business prospects. Will now say that our business during the past year has been better than ever before. The increasing demand for our tools has been such as to compel us to increase our manufacturing facilities. This we have done by taking possession of our new shop, containing 8,640 square feet of floor room, high-posted, well lighted, fitted up with modern improvements and the best of tools, driven by a 60 horse-power wheel (although this is more than we at present require), and we shall be better than ever before prepared to fill our constantly-increasing orders. We are anticipating a greatly-increased trade for the year to come, and shall add new machinery from time to time as our business requirements may demand.

A few days since we were pleased by receiving a diploma from Sweden, signed by the Crown Prince, Gustaf, for excellence of our fine tools on exhibition there.

We have several new and improved tools that we shall soon add to our list, and such as we believe will command large sales.

J. M. Allen, President Hartford Steam Boiler Inspection and Insurance Company, Hartford, Conn., writes us:

In reply to your favor, inquiring about the business of this company for the past year, I will say: The business of the company has been larger by far than that of any previous year, and the outlook for business the coming year was never more encouraging.

The Dwight Slate Machine Company (Machinery and Tools), Hartford, Conn., write us:

The year 1886 opened with prospects of good business, and orders came in freely in January and February. During the spring and early summer months business was quite light, but since July has shown steady increase the year closing more promising than 1885.

During the year we have brought out some new tools—two and four spindle drills, with novel driving arrangements, consisting of single belt and tightening appliance; also a filing machine for handling hand files by power. Have also purchased the tools, patterns and fixtures of the Ballou Manufacturing Company, of this city, and shall continue the manufacture of their fine precision engine lathes, bench lathes, and the numerous accompanying attachments.

Shall carry over the first of year quite a number of unfilled orders, and have fully three months' work ahead.

Brehmer Bros. (Bevel Gears and Machinery), Philadelphia, Pa., write us:

During the past year we have been fairly active, and have done considerably more than during the preceding year. At present we are pushed very much, and are behind hand with our orders.

We think it rather unsafe to prognosticate the prospects for the coming year, but for the first few months we expect to be very busy.

The Buffalo Forge Co. (Forges, Blowers, Blacksmith's Drills, etc.), Buffalo, N. Y. write us:

We take pleasure in reporting business good in all branches of our manufacture.

Among recent shipments of forges are: 10 forges for the Studebaker Wagon Works; 12 forges, Atlanta University, Atlanta, Ga.; 24 forges, Manual Training School, Toledo, O.; 6 additional forges, making 18 in all, to Abbott Buggy Co., Chicago; 6 forges to Groton Carriage Co., Groton, N. Y; besides preliminary shipments to Pennsylvania State Reform School and Haveford College, Philadelphia, Pa. We are also preparing addition to our original shipment of 12 forges to Cornell University, Ithica, N.Y.

In our ventilating department, we have recently shippd one large 14 foot fan to Northern Michigan Insane Asylum, Traverse City, Mich.; one same size to Retsof Mining Co., Piffard, N. Y.; one 12-foot fan to Weston, N. C., Insane Asylum Morganton, N. C.; one 4-foot disc exhaust wheel to Public School Department, Brooklyn; one 5-foot and 3-42 inch wheels to a Syracuse party, and one 4-foot wheel to a large paper mill in San Francisco, Cal.

The above are independent of routine shipments to our regular jobbing connection, which show a very gratifying increase also.

We shall have a number of new designs on hand, and power blacksmith drills to offer the coming year; also entirely original tool, for blacksmiths, adapted to a class of work which is now being done entirely by hand.

The National Pipe Bending Co., (Feed-Water Heaters and Iron, Brass and Copper Coils), New Haven, Conn., write us:

Our business for 1886 has shown a very gratifying increase over that of the previous years. We have added two new machines to our coiling department, and are now able to make larger coils than before. The last four months of the year has given us a large number of orders, and we have worked some overtime and added to our help. The price of material is going up some, but labor remains the same as in 1885. The demands for coils of iron and brass since July has exceeded that of any former year. The outlook for 1887 is very good.

Vanderburgh, Wells & Co. (Pattern Letters and Printers' Materials), 18 Dutch st., New York, write us:

Although our business for the year 1886 is slightly more in volume than for the year before, this gain was all in the earl months of the year. Since the labor troubles of the country became serious in the spring orders have been to a great extent, confined to what our customers could not get along without; showing that very few purchases were made with a view to the enlargement of old establishments, or toward starting new ones.

The prices for our goods are a little firmer than they were a year ago, and the general prospect seems fair, although there is not quite so confident feeling as there should be.

No change in rate of wages to report, and prices of what we buy much the same as they were a year ago.

We have added to manufacturing facilities during the year, but not to a great extent.

The Muller Machine Tool Company, Cincinnati, O., write us:

We commenced business last April with an entire new outfit, comprising the latest and most improved tools manufactured.

At present we make a specialty of 16" engine lathes, beds of any desired length.

We have furnished this tool to several of the largest machine shops in this city, and have received orders from all parts of the country for the same.

We make it an object to build this tool as fine and accurate as can be made.

Prices have been and are extremely low.

The outlook for 1887 seems bright, and we hope may terminate in a general business improvement over 1886.

We have had all we can do since we started.

The Variety Machine Company (Ratchet and Worm Drill Stocks), Warsaw, N. Y., write us:

Our business for 1886 has been all we could expect. It comes mostly from advertising. Where we make one sale, we are sure of more. Many machinists are adding our No. O ratchet to their kit. We think, with improved tools, sold at a reason ble price, all that is required is to "keep it before the people." We have sent our ratchets to all parts of the country, and all have given the best satisfaction. Have improved our facilities, so as to be able to fill orders more promptly. We expect to put a worm drill on the market soon. Think the outlook for 1887 is good.

Chas. A. Strelinger & Co. (Wood and Metal Workers' Tools), Detroit, Mich., write us:

Our trade for the past year, as a whole, has been entirely satisfactory to us, and we expect it to be as good, if not better, for the coming year. As a matter of curiosity, would tell you that we have just received a letter enclosing four post-office orders, of one shilling each, from Lucknow in India. Our correspondent says that he read our advertisement in the AMERICAN MACHINIST, and asks us to send him our catalogues. We always knew that the AMERICAN MACHINIST was pretty substantial, but were not aware that it covered so much ground before.

Forbes & Curtis (Die Stocks, Pipe Cutting and Threading Machines, etc.), Bridgeport, Conn., write us:

The year has shown us a larger output than '85. In some months our orders were twice as large, and we were forced to put in more machinery, and to-day we are crowded with work. We hoped to get into larger quarters, but have not been able to close our arrangements so to do. Our price for labor has not changed, nor have we been obliged to pay much more for material as yet, but some advance we look for.

We have added two new designs to our list of pipe tools—a new power machine and a nipple machine. We will be satisfied if '87 does as well for us.

The E. Horton & Son Company (Manufacturers of the Horton Lathe Chuck), Windsor Locks, Conn., write us:

Our business has been gradually improving during the year just past. We are now, and have been, running to our full capacity. We are constantly adding new sizes and styles to our line of chucks as fast as there is a demand for such. Our patent car-wheel chuck is giving perfect satisfaction, and our "Horton Giant" is attracting considerable attention, and orders are beginning to come in for it The prospect for doing a good business the coming year is good, and with the end in view of doing more, we have lately added some new and improved machinery to our works, and shall no doubt put in still more before the end of the year.

Oneida Steam Engine and Foundry Company (Lathe and Drill Chucks), Oneida, N. Y., write us:

The sales of the Westcott chucks in the past year have been remarkably good, and largely in excess of any previous year. We have had all that we could do, and are now increasing our capacity, by adding new machinery, and in using all the help we can find room for.

Since the boom of 1880-'81 we have doubled our fac lities for manufacturing, but still find it difficult to meet the demands of our customers.

There has been a marked increase of foreign orders, and home orders have taken a decided jump, as the year closes upon us. We look forward for a busy year.

The Kensington Engine Works (Limited), Philadelphia, Pa., write us:

The early part of the present year found us with a fair amount of work, and believing that the outlook was sufficiently promising, made a large addition to our works of a new boiler and blacksmith shop, thus greatly increasing our facilities. This belief of improved business prospects has been realized in the latter part of the year; and while we are not suffering from any "booms" (the bane of all legitimate business), we are working full hours, with an increased number ot men, and are still hopeful that the coming year will further increase our orders.

The Newburgh Steam Boiler Works, P. Delaney, Proprietor, Newburgh, N. Y., write us:

I have had a very busy year, and am well satisfied with the amount of business done, but prices have been too low for satisfaction.

The prospects for 1887 are good, and I am preparing to enlarge my shop in order to turn out work more rapidly.

The Mason Regulator Company, Boston, Mass., write us:

In reply to your inquiry as to business during 1886, and the prospects for the coming year, we would say that this year can hardly be taken as a criterion for our business, as we have during the last 12 months put upon the market several new patents.

Our original device "the Mason Pump Governor," with which we commenced business has during the year increased in sale. We have shipped a large number of these to Cuba and England, and they are being generally adopted in this country where such a device is necessary.

We have recently put upon the market a steam pump pressure regulator which has found immediate favor with the steam pump manufacturers; a steam trap for which we have filled orders from some of the leading brewers, sugar refiners and factories, and a reducing valve. For this latter article there has been a good sale, and although we have only manufactured it for three months, we cannot supply our orders. We have not added to the number of our workmen, but have made a large variety of special tools whereby we can manufacture our reducing valves more rapidly and cheaper. We look for a good business during the coming year.

The Bridgeport Boiler Works, Bridgeport, Conn., write us:

The battle of life, strife and competition is nearly over for 1886, and the result will soon be known in the summing up of the gains and losses.

We have not swerved from our policy of using the best materials, and making the best of everything in our line, and asking a fair price for our products, according to the times, and recognizing reasonable competition. Under this policy our business will be considerably more than that for 1885, and the earnings more satisfactory. We have been quite busy for the last two months, working ent rely on orders, having sold about all the stock we were able to make up during the summer months, and the prospects in inquiries and proposals out are unusually good for this time of year in our line. As we prophesied last year, prices have been the lowest in our experience of over thirty years in our line; and notwithstanding tubes, bars and plates have been advanced in price, we see no prospect of getting more profitable prices, because it will take a great demand to fill the facilities; possibly the crazy rush for all to be served at once. to meet the supposed coming boom, may advance prices some for a time, till the facilities are again increased to meet this rushing demand, which in our opinion is the most pernicious of all business operations, requiring, as it does, to do the year's work in six months. Another bad thing is, large concerns increasing their facilities to get more earnings out of the very small profit competition which present facilities award; one concern does this, and others follow, so that unless there is a great and increasing demand, all are worse off than before. It is our opinion that the best policy would be to keep prices and wages up, and reduce the product. But such is life, and no power on earth can control the rush of men to get rich and richer in as short a time as possible; but it is our opinion that it will take more and more time to get a competency, as the years roll on. Our predictions for 1884 and 1885 proved correct in the main; but we think the prospects for 1887 more promising with us than either of the previous years; and if the demand will cover increase of wages for skilled labor, and advance in prices of stock and a little more profit, we shall be agreeably surprised.

Fig. 3

Fig. 4

Fig. 2

The S. Ashton Hand Manufacturing Company (Machinery and Tools), Toughkenamon, Pa., write us:

Previous to November the past year has been quite dull with us. Since that time we have been very busy on special machines for sewing machine shops, with good prospects for plenty of work for 1887.

We are getting ready to manufacture our 14" engine lathes in large quantities, in order to compete with the market. We find that nearly all classes of buyers are looking more at price than quality.

Good workmen are scarce and wages about as high as ever with us. Material can be contracted for in quantities at very favorable rates.

We publish this week another lot of letters (the third lot) from manufacturers of machinery and tools. They show the machinery trade to be in good condition. All that seems lacking is an advance in prices, which is very likely to come soon.

A correspondent writing to *Industries* says that for sawing soft and medium woods, a speed of about 9,000 feet per minute increased to 10,000 for cross-cutting, is recognized as standard. For higher speeds than these the thicker saw required is too wasteful of lumber.

Standard Screw Threads.

BY JOSHUA ROSE.

The angle of the sides, one to the other, of the United States Standard, of the common V, and of the steam and gas thread, is said to be that of 60 degrees; but it can be shown that a thread can only have a standard angle upon one diameter of bolt or work, and that for this one diameter the angle of the thread is different from that of the tool that cuts it. This in no way detracts from the value of a standard, because it is by means of the standard that we are enabled to originate threads, and be sure that all those of a given pitch will fit, let the diameter of the work be what it may, and the actual angles of the threads vary as they may, upon different diameters of work.

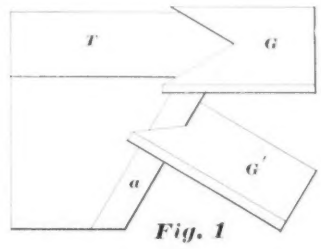


Fig. 1

Let it be supposed that a thread is to be originated, its sides to have an angle of 60 degrees, and there at once arises the complicated problem as to what shape the cutting tool must be to produce threads having that angle, for the angle of the tool differs from the thread it produces. This fact may be stated in another way, inasmuch as that the angle of the cutting edges of a tool differs from the angles ot the two clearance faces, which are factors in producing the cutting edge. This is shown in Fig. 1, where T is a tool, and G a gauge of an angle of 60 degrees. By grinding the end faces a of the tool at such an angle that the gauge fits the cutting edges of the tool, the cutting edges will obviously have an angle of 60 degrees, measured on the plane of the top face of the tool; but if we apply the gauge to the clearance faces, as a, we must hold it at a right angle to those faces, as at G', and it will then no longer fit, and it is clear that the production of cutting edges at an angle of 60° can, in a tool of this kind, only be obtained by grinding the end faces a (these being the only ones that are ground in resharpening the tool) to some other angle, and that this latter angle depends upon the amount of clearance given to the tool may be shown as follows: Suppose the tool is given no clearance, as in Fig. 2, and the gauge may be applied parallel to the top face of the tool, and at any part of the tool depth, and will still show the same result; or, in other words, if it fits the tool in position G, it will also do so in position G'. But the tool must have a certain amount of clearance on its end faces a, in order to enable it to cut, and it follows that for every variation in the amount of clearance the end faces a must be ground to some angle other than that of 60 in order to produce cutting edges that shall be at an angle of 60.

In the practice of the ordinary workshop this has a minor importance, because, so long as the tool is ground so that it fits the gauge when applied in position G in the figures, the workman need not concern himself with what particular angle or amount of clearance he has given to the tool in order to obtain correct cutting edges, all that he needs to insure being that the cutting edges are at the correct angle, and that the amount of clearance is suitable for the diameter of the work the tool is to operate upon, and the pitch of the thread the tool is to cut. But in the manufacture of threading tools it assumes great importance, because the fit and-try process is too expensive; hence a definite degree of clearance is adopted, and with it such an angle of end face as will produce cutting edges of the correct angle, when the gauge is applied parallel to the upper face of the tool.

When we come to apply a thread gauge to the work we are met with new considerations arising from the angle of the thread to the axis of the work, every varying angle giving in realty a different form of thread, although all the threads may be cut by the same tool, and, furthermore, although all the threads may appear correct when tested by a gauge applied parallel to the axis of the work.

But the actual angle of the threads cannot be measured in this way, as may be seen in Fig. 3, in which a rectangular piece of work is represented as having two V grooves, e and e cut in it at a different angle to the line $f\ f$ which may be taken to represent the axis of the work.

Suppose it was required to produce by hand a number of such pieces of work in which the grooves were to be exactly alike, and a male gauge such as in Fig. 4 must be made to test the grooves, the sides $g\ h$, being at an angle of 60° one to the other.

In applying this gauge to the work it must obviously be held at a right angle to the length of the groove as at G for groove e, and at G', for groove e, and when so applied the grooves fitted to it will have their sides at an angle of 60°, let their angle to the line $f\ f$ be what it may.

But if we then apply the gauge on the line $F'F$ neither of the grooves would appear to be correct, nor would any groove unless the center line of its length were at a right angle to the line $f\ f$

That a screw thread must, in order that its sides be at an angle of 60°, be measured in the same way is obvious, from Fig. 5, which represents two screw threads having the same pitch, but upon different diameters of work. Line $f'\ f'$ is the axial line of the work and corresponds to line $f\ f$ in Fig 3. Line $J\ J$ is the center line of a thread groove G represents the gauge applied, as at G in Fig. 3, at a right angle to $J\ J$, and G' the gauge applied at a right angle to center line $K\ K$ of a thread groove, hence if the sides of both grooves were at equal angle the gauge would fit equally to both. But in cutting the thread the plane of the cutting edges is parallel to the axis $f\ f$, and in gauging it the gauge is also applied parallel to the axis; hence the angle of the thread varies upon every different diameter of the work and can only be a standard angle when a certain thread pitch is considered with relation to a definite diameter of work, as in the case of the United States standard.

But so long as the tool and the gauge are both applied parallel to the axis, work threads of equal diameter and pitch will fit together correctly, notwithstanding that the thread angles may vary with the work diameter. Hence, it is to be considered which is the most convenient method of cutting and of gauging the thread.

Robinson's Feed Water Heater.

The heater proper consists of a vertical shell, with a series of tubes, the central one being larger than the others. This shell is surrounded by another which encloses a small space, except at the top and bottom, where there are comparatively large chambers enclosed.

The exhaust from the engine enters at the bottom through pipe *A*, and passes up to near the top of heater, and into chamber *E*. From there it passes down through the tubes and through the space between the shells, to lower chamber *K*, and into pipe *I*, whence it may pass to the atmosphere, or to the condenser, or may be conducted away and used for heating purposes.

The water is forced in through pipe *H*, and passes out to the boiler through pipe *G*, thus becoming heated before coming in contact with the shell or tubes of the heater. A circulation of water is maintained by its rising upward in contact with tube *C*, and flowing downward in contact with the surface of chamber *P*. Impurities are carried to a comparatively quiet space above and below *P*, and may be blown off through pipes *O* and *J*. The heater contains water enough to supply the boiler for twenty minutes, which is sufficient to allow for heating, and to permit impurities to settle, or to rise to the top.

The steam from pipe *A* escaping in a vertical direction into chamber *E*, and leaving it in the reverse direction, maintains the chamber full, equally supplying all the tubes and space with heat. The currents of steam are downwards, thus relieving the heater of the water of condensation.

The head of the jacket is arranged so that it can be removed, and the heater removed from the jacket, in case repairs are needed; hand holes are provided for inspection, but if the blow-offs are properly used the heater will be kept clean. It is claimed that there is no unequal expansion, hence there is no occasion for providing for it.

One and one-half square foot of heating surface is allowed for each horse-power. The connections for water pipes being at the top and bottom these pipes may conveniently be led in any desired direction.

The manufacturers of this heater are Robinson & Cary, St. Paul, Minn.

Simple Blue Process.

For Reproduction of Maps, Drawings, Circulars, etc., with Blue Lines on White Ground.

PREPARATION OF ORIGINAL.

PAPER.—Use a thin, white, transparent paper, similar in all respects to that known in the Keuffel & Esser Catalogue as "unprepared German transfer paper."

INK.—A thin solution of gum arabic, colored with Prussian blue, carmine or Indian ink.

MODUS OPERANDI.—Draw or write directly on the above paper or trace original on it. Now spread the paper face up on a smooth surface (fastening with thumb tacks), and cover well and uniformly with dry, finely-powdered Tuscan red or ivory black, distributing and rubbing it in with the palm of the hand. Avoid getting any coloring matter on the back. Examine the sheet by holding up to the light and remove lumps with a soft brush. The sheet, when well coated and held to the light, will appear of an even shade and unspotted. Now turn the sheet face downwards and saturate it thoroughly with poppy or linseed oil, using a warm flatiron. The coating thus being fixed, the sheet should be washed under a gentle stream of water, which will cause the lines of the drawing or writing to appear transparent on a red or black ground. Then hang up to dry.

PRINTING.

Use, in the customary way, ordinary blue process paper (heavy paper being preferable), which should be of good quality and not very old.

If the ground of the print should appear cloudy on account of the imperfect coating of the original, add to the second bath a few drops of a saturated solution of chloride of lime, and watch the bleaching. When the ground is perfectly white and clear, wash again in clear water.

HENRY BOSSE,
Draftsman.

U. S. Engineer Office, Rock Island, Ill.

The manuscript from which these directions have been printed, is, we believe, a reproduction of the original and obtained by this process. If so, the result is excellent, and since the process is comparatively simple, our readers may find it to be advantageous to adopt the same.

Carrying Steam Through Streets at High Pressure.

The New York Steam Company has been extending its business during the last three or four years until it has seven or eight miles of main pipes running through the streets, supplying steam, heat and power to hundreds of customers. It has met considerable opposition at times, and lately the Board of Aldermen passed a bill requiring the pressure in its mains to be reduced to 50 pounds. The Mayor vetoed the bill.

It has been urged that the city is in danger of malarial poisoning from leakages of the main steam pipes. It is said that the pipes are leaky in many places, and that the miasmic emanations thereby occasioned are deleterious to the public health, and cause diseases.

In order to learn the pros and cons of this public question, a reporter of the AMERICAN MACHINIST called upon two gentlemen, who, from their positions, have taken sides prominently for and against the company. The first was Charles E. Emery, Chief Engineer of the New York Steam Company. He was found at his office in Cortlandt street, and was ready to talk upon the subject, although, as usual, his time was limited. "There have been efforts made to limit the pressure in your pipes to fifty pounds to the square inch," began the reporter. "How have these efforts resulted?" "Oh, as to that," rejoined Mr. Emery," there is absolutely nothing in it. It is a fact that such an endeavor was made, for what purpose nobody knows. The aldermen even went so far as to pass a law to that effect. But it amounted to nothing for it was promptly vetoed by the Mayor. Such a law therefore has never been in force. That matter may be considered at rest."

"You are making improvements from time to time?"

"Yes. We have introduced a system of returning the waste waters to our boilers. This innovation is attended with great expense; but we have determined to adopt it."

"It is claimed by certain expert sanitary engineers that there is a constant leakage from your pipes, and that this must be injurious to the health of the city."

"In answer to that allegation I may say, in the first place, that if steam escapes, it is hot enough to kill any germs of disease instead of generating them; secondly, if water escapes, at least it is clean water. There is nothing poisonous or hurtful about it. It contains no objectionable matter. No evil can come from it. If there should be any leakage, the water is readily absorbed by the soil, and does no possible damage. One would think, from the objections of some people to our system, that we were transmitting some deadly fluid or poisonous gas through these pipes."

"Was there not a good deal of opposition to your company's new plant in the upper part of the city?"

"It is true that, at first, there was some hostile feeling manifested toward us among some of the owners of adjoining property. But it has entirely disappeared. The fact is that, instead of an injury, our establishment up-town will improve the value of property in its vicinity."

To "hear the other side" is a time-honored maxim, and it may, perhaps, do no harm to follow its injunction in the present case. No one needs an introduction to C. F. Wingate, the Sanitary Engineer. To him the reporter applied for his views of the question at issue.

"Well," responded Mr. Wingate, "my opinion to-day is what it was when I sent my report to an investigating committee. I have seen no reason to change it. As I stated then, the facts in the case are as follows:

"The company maintains some 7½ miles of street mains, covering the district from Duane street to the Battery, and are making further extensions. These mains are of an average size of 10 inches, and are laid at an average depth of six feet. They are made of lap-welded wrought iron, but the material, it is declared, is not always of the best, as, owing to the intense heat, to which the material is subjected in the process of making, it becomes crystalline, or what is technically known as 'cold short,' and is then, in the opinion of experts, not one-third as durable as ordinary boiler iron. Under pressure of 90 pounds to which these pipes are now subjected they are

ROBINSON'S FEED WATER HEATER.

constantly liable to leakage, and there is also risk of fracture or forcing of joints.

"During the year 1885 no less than 286 permits were granted by the Department of Public Works to open streets in order to repair leaks in the Steam Heating Company's mains, and during the present year a proportionate number of applications have been made for the same purpose. The extent of these leakages is further shown by the statement of the engineer of the company that the annual loss from this cause is equal to 600-horse power, which is equivalent to a wastage of more than eleven million feet of condensed steam. This vast volume of heated fluid percolates through the soil in all directions, forming channels along the line of house drain connections, heating up adjacent water pipes and sewers, and undermining the streets in all directions.

"The heat and moisture thus created, combining with the organic matter in the soil, supplies all the essentials for the propagation of malaria. There is also a large leakage from street gas mains, and from defective sewers. Even a well constructed sewer might be injuriously affected by the leakage from a steam main, through the corroding action of the escaping steam upon the cement and drains connecting from adjacent houses. But in old and defective sewers, ill-ventilated and ill-flushed, the effect of such leakage must be exceedingly harmful. Decomposition will be assisted, and the foul gases thereby created will be forced through traps, and into dwellings.

"Where drains are laid in made land the miasma created in the soil will be drawn directly into houses, as has frequently happened with escaping gas from leaking street mains. So many sub-cellars down town are lower than the sewer line, that any ground soakage would tend toward them. I have noticed a strong odor in such basement vaults. Hundreds of warehouses and stores have vaults extending under the sidewalk, and the Steam Heating Company have had to carry their pipes directly through these vaults, where a break or a leak might do great damage.

"It is claimed that the mains do not heat the ground around and above them, because the snow in winter does not melt any sooner along the street above the steam pipes than elsewhere. This may be true, yet it is nevertheless undeniable that large water mains are warmed by contact with the steam mains, and that leaks may be detected by the more rapid drying of the ground above them in rainy or snowy weather. In the course of time, as the strain becomes greater, these leaks will doubtless multiply, and their effects become more extended. It is not surprising to learn that already malarial sickness is reported on the increase in the region along the line of the company's mains, and its further extension is to be expected.

"From my personal experience I know that many cases of serious sickness are contracted in office buildings where business men and their employes are too absorbed in their daily routine to observe this foul and poisonous atmosphere, which is their lung food. The fact that the annual death rate from zymotic disases, in 1884, in the Second Ward, embracing Wall street and its immediate vicinity, and comprising janitors and their families, is 33 per cent. higher than in any other ward in the city but one, is worthy of note. In 1876 the rate was 38.50. A large proportion of this mortality was due to consumption and like maladies. In my opinion dangers will result to the public health, if the present constant saturation of an already much-polluted subsoil is allowed to continue."

The *National Labor Tribune* says:—"If reports be true that G. M. W. Powderly has levied 'a special defense assessment,' we opine that it is the beginning of a policy that will keep him busy dealing out money to, in some cases, undeserving Knights as long as he remains at the head of the order. There is a class of men in all trades and labor unions who would prefer to be 'victimized' rather than work—when they know that there is a special fund set aside for their maintenance."

What Lyons Sells to the United States.

United States Consul Bryan, at Lyons, France, makes a tabular statement showing the value of declared exports from his consular district to the United States during November, 1885 and 1886, and for the first eleven months of those two years. The total for the first eleven months of 1885 was $7,393,298, and for the same period in 1886 it was $8,592,797, being an increase of $1,199,498. The largest item is that of "silk and velvet piece goods and ribbons," and the next largest "raw silks." Argols make the third largest item in the totals. There are other classifications of silk, such as "crapes, laces and gauzes," "organzines silk," "silk trimmings," "waste silk, raw and pierced cocoons" and "waste silk combed," which, together, make silk constitute most of the declared exports. The total for November this year is somewhat smaller than for the same month last year. The Lyons exports of "manufactures of iron" to this country amounted to about $33,000 for the eleven months of 1886, being about twenty-five per cent. less than for the same time in 1885. The quantity of silks annually sold in this country, as made in Lyons, is several times the value of the declared exports of that article as tabulated by Consul Bryan.

W. H. Thomas, superintendent of motive power of the East Tennessee, Virginia and Georgia Railroad, has issued the following circular:

"Mr. J. B Michael is appointed master mechanic of the East Tennessee Division, vice Mr. B. J. Sitton, resigned to accept a position on another road.

"He will have charge of both locomotive and car departments, with headquarters at Knoxville.

"Mr. C. L. Petrikin is appointed master mechanic of the Alabama Division, vice Mr. J. B. Michael, transferred, with headquarters at Selma, Ala.

"Appointments to take effect January 1st, 1887."

The circular is countersigned by C. H. Hudson, general manager.

Erwin W. Thompson has retired from the superintendency of the Oliver Oil Company, Charlotte, N. C., and accepted the position of manager of the Augusta Oil Company, Augusta, Ga.

Moulding Pulleys.

BY ROBERT E. MASTERS.

If a firm does considerable business in small pulleys or makes a specialty of that class of work, the cheapest and best way is to make them on a machine, as suggested by a correspondent in this journal November 27, 1886. A detailed account of the operation (with illustration) of one of the best machines for this class of work appeared in the AMERICAN MACHINIST, April 11, 1885. Pulleys are made (if it is only occasionally) in nearly every foundry in the country, but comparatively a small number of them are justified in investing a thousand dollars for a machine.

As was stated in the beginning of this series of articles of moulding pulleys—no matter how well equipped a foundry may be there are often orders received in which 'make-shift" appliances have to be resorted to, to produce the desired results. The firm with which I am associated have been doing a general foundry business for over fifty years and have four large foundries in operation. I was impressed with the truth of the above remark when an order was placed with us last week for two pulleys, 57″ diameter, one of them to be 6″ face and the other 12″ face. This is an odd size, and none of our later day patterns or riggings were suitable, but among the stored away "old time rocks" we found an old wooden pattern of the right diameter, 8″ face. There was no parting about it whatever, the rim being in one piece, the arms fast to the rim and the hubs fast to the arms. The only alteration we made in the pattern was to pull off the hubs which were not the right size and bore a hole in the center of the arms to set on hubs of the size required.

The illustrations show the moulding of both pulleys, so the arms will be in the center on plans, though somewhat old but very little used, and which can be successfully employed in making pulleys with broad or narrow face from old pulleys.

To mould a 12″ face from an 8″, screw the bottom hub and core print fast to the arms, lay the pulley on a level bed and put on a 12″ cheek, then ram up under the arms, and outside of the pulley, draw the pattern up 2″ as shown by the spaces *A A*, Fig. 1. The pattern will then be 2″ from the top of the cheek *B*. Tuck in under the hub and arms, ram the sand up to the top of the cheek on the outside of the pattern and make a bevel parting *C C* from the inside of the rim to the top of the cheek. After the plate has been put in to lift the sand out over the arms and the core rammed as far as *D D*, put paper or a thin coat of damp sharp sand on the parting *C* and ram up to the top. When lifted out cut the sand *C* on the core side away with a short strike, then cut the sand away over the pulleys or rim, draw out the pulley, lift off the cheek and dress it up. Pulleys 20″ face have been made on this plan from old pulleys 8″ face, and the arms kept in the center.

Fig. 2 shows two ways of making a 6″ face from an 8″, keeping the arms in the center. In either case bed the pulley in the floor 1″ below the parting or ground line *E*. On the left we have a 6″ cheek *F*, the pulley extending 1″ above the cheek. Ram up the mould and form a parting as at *G*. After the cope has been lifted off fill up the space made by *G* in the cope. Before lifting out the core over the arms, with the strike Fig. 3 cut the sand *G G*, away level with the cheek, then finish the mould as usual. On the right of Fig. 2 the pulley is bedded in 1″ below the parting, and the drag *H* level with the pulley. In this case after the cope is lifted off the strike Fig. 3 is used to cut the sand away 1″ deep at *I I*; then lift the core *J* out from over the arms, draw out the pulley and set the core back in again, then put segments of either cores, tin or pasteboard over the rim in the space cut away at *I I*, and fill up over them. Sometimes the strike, shown to the right of Fig. 3, is used cutting away only on the outside of the rim, but this does not give as good a bearing for the segments to cover the rim, and there is more danger of sand getting in the mould than when strike, Fig. 3, is used. Of these plans for making the face narrow the first described to the left of Fig. 3 is the quickest and safest.

In regard to mica for covering risers, F. B. Sheffer claims he "knew that long ago," and that Mr. Cunningham is laboring under a delusion in thinking the idea is original with him. We had tried glass with the same result Mr. Shaffer speaks of, and I am satisfied from the circumstances that the idea of using mica first occurred to Mr. Cunningham at the moulding of the piece spoken of in AMERICAN MACHINIST, Nov. 6th, 1886. No matter how long it may have been known before, the use of mica for that purpose was first made public by Mr. Cunningham through the columns of the AMERICAN MACHINIST, and the readers of that journal who "did not know it before" will no doubt do him credit for the information.

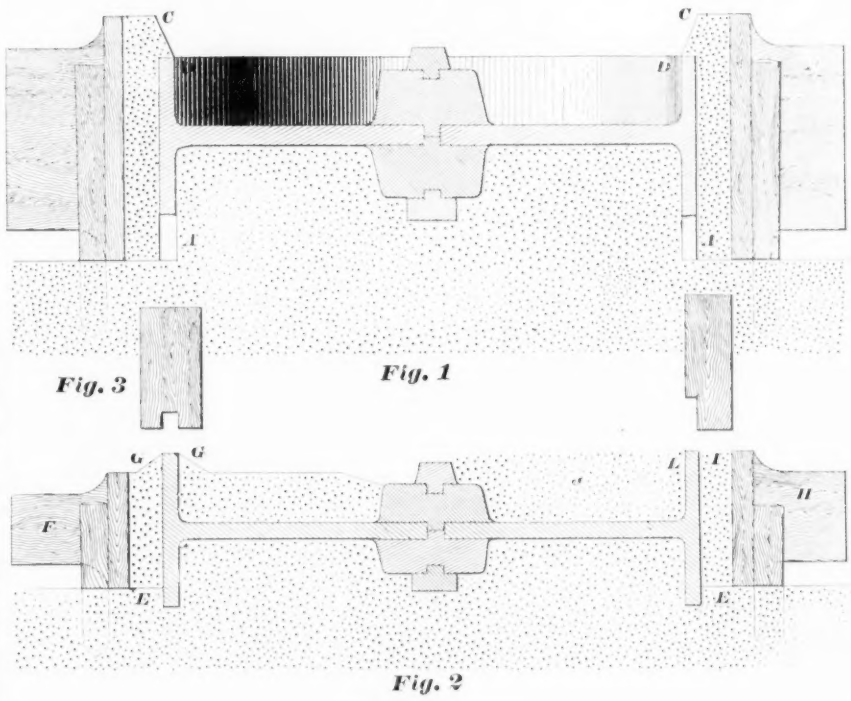


Fig. 3 *Fig. 1*

Fig. 2

MOULDING PULLEYS.

We observe in the most recent issues of two or three of our Western industrial exchanges (weeklies), a large advertisement of "the growing town of Kanopolis," by a land company that announces a "public sale of lots October 15th and 16th, 1886." The advertisement says, "Don't wait for the public sale, but come and make your own selection of lots." It appears to us that the land company must have got very much belated, or else our contemporaries have become so. Before inquiring the price of corner lots in that town we shall wait for fresher announcements.

There is considerable interest among railroad men in this country in the success or failure of Webb's compound locomotive in Europe. As the London and Northwestern Railroad is having thirty of these locomotives built, it looks as though some success has been achieved.

LETTERS FROM PRACTICAL MEN.

Chucking Lathe Work.

Editor American Machinist:

It often occurs that a lathe hand has work to chuck which must be trued by the outer periphery, and has trouble in consequence, especially where he cannot pass the bolts through the face plate, owing to their coming too close to its hub or center, which prevents him using straps on the face of the piece to be chucked. The most prevalent method is, to use a drill with a center in one end of it, to hold the work against the face plate until trued, and the necessary pressure to accomplish this invariably destroys the tailstock center. In truing small pulleys and other work that has light shells which would yield to an ordinary jawed chuck (which in any case is not reliable where the grip is limited by the strength of the work), the following wrinkle has been of great service to me, and as I have not seen it used by anyone else, it may be appreciated by some of my fellow-mechanics. There are few face plates whose thread does not extend from three-eighths to half an inch beyond the end of the lathe spindle, and the use of this extra thread in the following manner will often save the shears of a lathe, avoid the risk of having to true up the center, hasten the work and prevent considerable swearing: Bore out the thread in face plate to a depth of an eighth of an inch, in order to form a shoulder, then turn a plug to fit the thread, and a shoulder to correspond with recess. After screwing it in, bore and tap a hole in the center for a five-eighth or most suitable bolt, then drill two small holes for a spanner, and it can be readily screwed in or out. You can then pass a bolt through the work and secure it to face plate until trued, when you can apply the straps. I have turned pieces six and eight inches in diameter secured with one bolt, by placing a thin sheet of paper between the work and face plate. In slacking the bolt, the plug will not screw out, which the grip on the larger thread provides against.

J. A. ROTHWELL.

Independent Thought in the Shop.

Editor American Machinist:

I see by your paper that Mr. Horatio Allen, in his address to the New York meeting of Mechanical Engineers, among other things deplored the lack of thought on the part of individual mechanics. Right there I think he struck the key-note of the proper apprentice system.

Earnest independent thought on the part of any boy or young man who has set out to make a mechanic of himself will certainly bring him both knowledge and skill in his chosen calling.

We hear or see statements every little while that, as machine shops gradually grow into manufacturing concerns, the work is systematized until there is nothing but routine in the different classes of work, and that a boy apprenticed to one of these establishments "gets no show" in the shop, and is "no good" when his time is out.

That a graduate from, say, a steam pump shop, going to any other shop doing a different class of work must work for small wages, in order to "hold a job," because he cannot take hold of work as it comes along and do it intelligently. He is pictured as being sent out of the shop to make some repairs upon a steam engine, or line up a shaft in a brewery, or to fix an hydraulic elevator that is on a strike.

After wasting an hour or two of time, he admits that he is "stuck," and goes crest-fallen back to the shop, taking this message to the foreman, "Send up a machinist next time." And then the parties get their work done at some other shop, and refuse to pay for what our pump man has done, because he did not know what he was about. He actually caused damage by his ignorance. Why is this? He might have been a good man in the pump shop, but fails immediately on attempting printing press or sewing machine work. He has learned to turn and bore, to plane and slot, to chip, file and scrape, but he fails when asked to perform any of these operations on anything except a steam pump. Is it because he has not lea ned to do these things well, or because he did not use his brains while learning to use his hands?

Machine shops are always overrun with applicants for apprenticeship. But nine-tenths of the applicants for places never think of anything beyond getting into the shop. Of their own fitness for the machinists' trade they never inquire into. They expect to work three years for a little less pay than they could get shoveling, and then blossom at once into a first-class, well-paid machinist, with no particular mental effort on their part. The result is easy to see. We see it every day in the army of workmen who can do only the commonest kind of skilled work, and oftentimes in only a single branch of the trade of which they call themselves masters.

This I claim is from a want of thought on the part of the boy or man himself. The steam pump man if he has mastered the trade as far as taught in the steam pump shop, has mastered the principles upon which the steam pump operates, and is a competent man to send out to repair a gas engine or a printing press. But this he cannot do without thought, and thought is but another name for study. The study that it takes to master the principles of the steam pump will incidentally bring knowledge of other machinery that cannot fail to be of use some time.

A boy once taught the habit of individual thinking about his work, a place in the front rank of mechanics is sure to be his. Thought will give him confidence and skill, and with these two elemen's in his mechanical make-up he will prove a valuable man anywhere he is employed, whether they build saw-mill machinery or machine tools to build saw-mill machinery with. F. L. JOHNSON.

Waukesha, Wis.

Making Blue Prints.

Editor American Machinist:

In No. 51 I see C. H. Pickering asks for information about blue prints. Knowing the value of good blue prints I showed the piece to our chief draftsman, Mr. Ford, with the request that he would furnish me with answers to the questions as numbered. He kindly furnished the following:

1. The best sensitizing solution is $1\frac{1}{4}$ parts red prussiate potash dissolved in 5 parts water, and $1\frac{7}{8}$ parts amoniated citrate of iron dissolved in 5 parts water. Keep separate until ready to use, then mix in equal quantities. The water should be free from any alkali. Rain water is best. No gum is necessary.

The best paper for the purpose is helios.

This is the best way to prepare the paper: Tack the paper lightly on a level board and spread thoroughly and quickly with a sponge. Lift all free solution with the sponge so as to have it smooth. Keep in a dark drawer.

The best way to wash the paper is as follows: Let the paper soak for 15 or 20 minutes in a tank of clear water. This water must be changed frequently, as the water soon becomes so saturated with the chemicals that it will not fully take the lines out, which will then become blue on exposure.

The question was asked: How long after the paper is prepared should it be used to get the best results? Use as soon as perfectly dry. If a drawing be made on transparent paper, parchment paper is best. This is cheaper than tracing cloth, but if time is money the cloth is the cheapest. Average exposure is 3 minutes for cloth and 25 minutes for the paper.

Another question asked was: If a tracing is made, is tracing cloth or some kind of transparent paper best?

Cloth by all means; you can make your pencil work on cheap paper, and trace at once, using the tracing cloth for a reference drawing while the blue prints can go in the shop.

This is how to know the color when a print has been sufficiently exposed: With a tracing cloth negative, an edge uncovered by the cloth should be of a greenish gray with metallic scintillations.

It can be done with dull back tracing cloth, by rubbing the spaces on the dull side with a soft lead pencil. J. J. BINGLEY.

Length of Diagram from Pantograph Motion.

Editor American Machinist:

Doubtless many of your readers have been bothered when using the pantograph as an indicator reduction motion, for want of a method for determining the location of the hitch pin in order to adapt the pantograph to the stroke of the engine in hand, so as to produce a card of the desired length. It is to be hoped that some day the pantograph makers will stamp a figure alongside of each hitch pin hole, showing at a glance the ratio of reduction for that hole, but until that good time comes the following plan is better than guess work or trial. Stretch out the pantograph until the distance between the fulcrum pin and the pin for crosshead connection is equal to the length of stroke of the engine to be indicated, then the distance from the fulcrum pin to the hitch pin is equal to the length of card that the pantograph, with the hitch pin in that location, will take from that engine. If this length of card is not satisfactory it is easy to adjust the hitch pin until it is satisfactory.

In setting up the fulcrum post it is not necessary to pay any attention to what has just been outlined as the same length of card will be taken regardless of the location of the post. Locate the hitch pin as described, and then set the post to suit your convenience. Of course the distances given are center to center. FREDC. A. HALSEY.

Tarrytown, N. Y.

Removing Borax from Steel.

Editor American Machinist:

One of your correspondents asks how to remove borax from steel axles without filing. Let him try immersing in a solution of sulphuric acid and water for a few minutes, afterwards dipping in clean hot water. He can then dry with a piece of cloth; we use this process for work in our establishment, and can recommend it.

Philadelphia. RIEHL & CLARK.

Combustion of Coal.

Mr. William Kent gave an interesting talk on combustion before the Newark Association of Stationary Engineers at one of their recent meetings. After briefly outlining the theory of combustion, Mr. Kent spoke of the different requirements for burning bituminous coal as compared with anthracite. The burning of anthracite was generally a simple matter, but with coal containing 30 per cent., or more of gases, the matter was quite different. Anthracite could be burned in a shallow furnace, but to get anything like satisfactory results from bituminous coal the fire-box must be deep, or a large per cent. of the gases would pass off unconsumed. Anthracite could be very satisfactorily burned in a furnace proper for bituminous coal, but bituminous coal could very seldom be used in a furnace made for burning anthracite without serious loss. Again there were so many varieties of bituminous coal that in order to get the best results the requirements for each must be determined from actual practice.

He spoke in favor of rather more than moderately rapid combustion, resulting in what is called a "bright" fire.

In regard to height of chimney, he quoted the advice a well-known firm of engineers gave their patrons, viz., to build their chimneys at least 80 feet high, and as much higher as they are inclined to.

He advised engineers not to trust their eyesight for a guide as to the completeness of combustion; nothing was more likely to deceive. Every engineer should have means for determining how much water he was evaporating per pound of coal. The matter was simple; some kind of a measuring tank to feed from, and scales for weighing the coal. In this way an engineer could detect what might be wrong in the quality of coal or the way it was burned. By adhering to one plan of firing and management for, say a week, then trying another plan, the best one would be found. There was no way except by actual trial that these things could be determined, and the best results obtained.

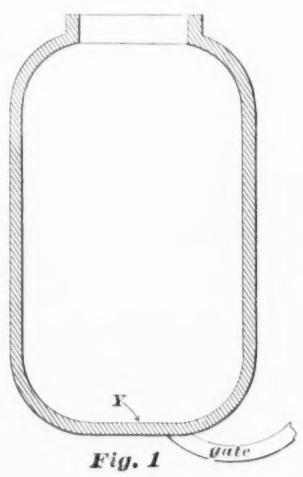


Fig. 1

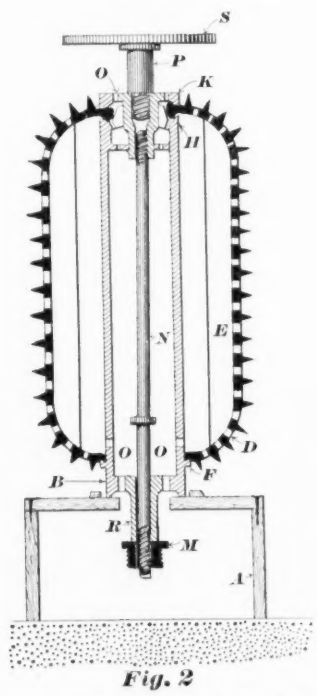


Fig. 2

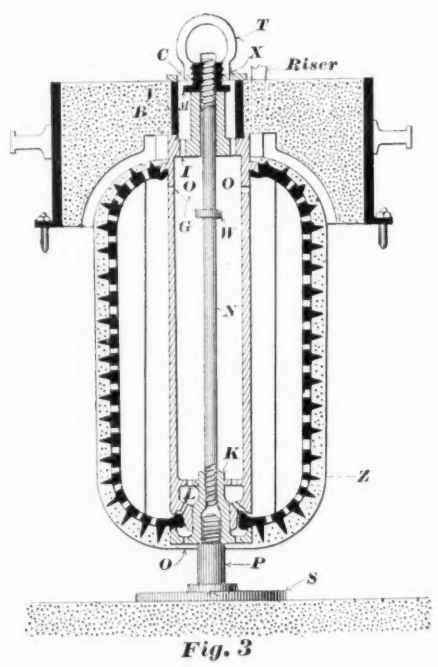


Fig. 3

A NOVEL GREEN SAND CORE BARREL.

A Novel Green Sand Core Barrel.

BY THOMAS D. WEST.

To originate a green sand core barrel for such a casting as is represented by Fig. 1, all moulders will agree is a somewhat difficult job. That shown is one devised by James Taylor, of the Holly Works, Lockport, N. Y., and is in every way a creditable job for the purpose.

The size of air vessels, made with such a plan of core barrels at the above works, ranges from about 18″ to 40″ diameter, and in length from 36″ to 72″, and with the rigging described excellent castings are made, and much labor saved in their production.

In starting to make the core the first operation is that of "setting up" the core barrel, the bench *A* having been placed as seen at Fig. 2; the shaft *B* is set on it, and staves *D*, which are about 8″ wide and strengthened by a rib *E*, are placed in the dovetails *F* and *H*. The staves being all set the cap *K* is then put on and the bolt *N* screwed up, after which the nut *M* is put on and the whole structure bound by the same, and the driving of a few wooden wedges between the joints of the staves *D* upon which are ¼″x1″ chipping pieces put on mainly for the purpose of keeping the staves apart at their joints, to leave a longitudinal opening for vent and freedom in getting them out of the casting.

The stand trunnion *P* being then screwed into the cap *K*, the core barrel is ready to be swept up, which is done by setting it horizontally on horses, the trunnions *P R* being bearings upon which it will revolve, as well as abuttment for the sweep in gauging the diameter of the core.

The core having been swept up the crane is hitched to the trunnion *P*, and that end of core lowered until the flange *S* rests on a block or plank sufficiently high to keep the body of core clear of the floor. The crane is then taken to the other end of the core and hitched to the screw hook *T*, seen in Fig. 3, (it having previously been screwed to the nut *M*, which is to be understood as having an external as well as an internal thread upon it) and the whole core up-ended in the position seen in Fig. 3. The mould or outside part being made, the cope is then set on the core, as seen in Fig. 3. The outside and bars of this cope are cast in one piece, which has for its center a ring *V* turned to fit the recess seen in the core barrel shaft *B*. These two being true and clean it will be evident that when the washer *X* is set on, and the screw hook *T* tightened, there will be positiveness in assuming the core being central and held in a position which head pressure in pouring cannot disturb.

The cope and core being secured as above described, the crane is then hitched to the cope trunnions and the whole hoisted up, after which the stand trunnions *P S* is unscrewed and the hole plugged with firmly rammed sand, thereby leaving the bottom of core all sand, and such as will give the casting the shape seen at *Y*, Fig. 1.

The core's vent is relieved by means of the vent holes seen in the staves and at *O L G I* and *C*.

The only trouble that occurred in making these castings, was caused through moulder's carelessness in allowing the vent holes *O* to become closed. A few castings came out having sand streaks in them caused through scabs, and for a while it puzzled the foundry foreman, Mr. Taylor, to fathom the cause. New mixtures of sand, etc., were tried, but all was of no avail until one day he happened to pick up the cap *K*, and observed that the vent holes *O* were all closed. At once he saw the cause, and informing the moulder he was greeted with the remark: "I never knew there were vent holes in that thing." If he had thought as a moulder should, he would have known that such a surface as the cope *K* had some provision for venting. But just such trifling little things are overlooked in every foundry, and on account of the trouble, expense, etc., they have caused would, if printed, make a book larger then all combined upon the art of moulding. The above incident is a good example of what trouble and anxiety a thoughtless moulder can put a foundry foreman to.

From the cut of the cope it will be evident to the founder and moulder how the rest of the flask was constructed when he is here informed that another joint was at the line *Z*, and the castings were poured by two underneath gates, one of which is seen at Fig. 1. The main runner to these gates did not pass through the body of the "cope" and "cheek," but had an independent pipe flask outside of the main flask which connected with a branch leading from the nowel that contained the gates shown. It will be seen there was no room for a runner inside of the main flask when the moulder is told that the diameter of the flask was such as would only leave room for about 3″ thickness of sand all around the pattern. It might be well to state that in order to insure the pattern being central in the flask when it was being "rammed up," that there was a seat in the pattern which fitted the cope's round bar *V*, and was bolted to same upon the principle the core is shown attached to the cope. The moulder will, of course, realize by the above that the cope was made to answer the purpose of a "follow" or "mould board," and that when the "cheek" and "nowel" were rammed up, the whole was turned over and the "false cope" removed, a joint made and the cope being replaced, it was then rammed up. In closing the mould, the "cheek" and nowel being together, the core as now seen would be lowered into them, and the whole would be secured against "head pressure" by clamping or bolting the flanges together. After the pouring, and as soon as the metal has solidified, the cope is hoisted off and the shaft *B* pulled out by means of replacing the nuts *M T* and unscrewing the bolt-rod *N* out of the cap *K*, and letting the collar *W* come up against the shaft's end. This will permit freedom for contraction and leave a hole whereby the staves can by hand be readily taken out of the castings when it is cold, as the wooden wedges referred to above have burned or charred away sufficiently to leave the staves loose. The rigging and ideas presented are valuable, and many will feel thankful to Mr. Taylor for allowing this publication.

Some young men of Toronto, Canada, are starting a Mechanics' Institute, for the discussion of mechanical subjects, and for mutual improvement. We wish them success.

Practical Drawing.

BY J. G. A. MEYER.

FOURTEENTH PAPER.

Problem 17.

149. TO DRAW A STRAIGHT LINE WHICH SHALL BE TANGENT TO TWO GIVEN CIRCLES, WITH THE POINTS OF TANGENCY LYI G UPON THE SAME SIDE OF THE LINE JOINING THE CENTERS OF THE GIVEN CIRCLE.

Fig. 113. Let *A B D* and *E F G* be the two given circles; it is required to draw a tangent to these circles, whose points of contact will lie upon the same side of the line *C H*. Under these conditions two tangents can be drawn to the given circle, namely, one above, and one below the line *C H*. We will first draw a tangent above the line *C H*.

Through the centers *C* and *H* draw a straight line, and produce it to meet the circumference *A B D* in the point *D*; then will *D C* be a radius of the circle *A B D*. From *D* as a center, and with a radius equal to that of the circle *E F G*, namely *E H*, describe a small arc, cutting the line *D C* in the point *K*; then *K C* will be the difference of the two

radii $D\,C$ and $E\,H$. From the center C, and with a radius $C\,K$ describe the circle $K\,I\,L$; from the center H, and with $C\,H$ as a radius, describe an arc, $M\,C\,N$; from the center C, and with a radius equal to the diameter $K\,L$ of the circle $K\,I\,L$ describe a short arc cutting the arc $M\,C\,N$ in the point M. Through the center C and the point M draw a straight line cutting the circumference $K\,I\,L$ in the point I, and also the circumference $A\,B\,D$ in the point B. Join the points I and H by a straight line, and draw the radius $E\,H$ perpendicular to $I\,H$; then the points B and E are the points of tangency. Through the points B and E draw a straight line; then this line $B\,E$ will be the tangent required.

By construction the line from B to I is equal in length to the radius $E\,H$, and the line $I\,H$ is perpendicular to $B\,C$ (Art. 125). The lines $B\,I$ and $E\,H$ are, by construction, perpendicular to the same line $I\,H$; they are also equal in length. Consequently the line $B\,E$, drawn through the points B and E, must be parallel to $I\,H$. The line $B\,E$ must also be perpendicular to the lines $B\,I$ and $E\,H$, because all the angles formed by these lines are right angles. Therefore the line $B\,E$ is the tangent required.

In a similar manner the tangent $A\,G$ can be drawn.

Directions.—In the space marked Prob. 18 draw any two circles whose diameters are not equal; assume these circles to be the given circles. Then draw a tangent to the same, according to the instructions given in this article.

Draftsman's Method.—In order to draw on paper a line tangent to two circles, the draftsman will simply place the T or set square in a position in which the edge of one or the other will touch each circle in one point, and then draw a line along the edge. If it is necessary to locate the points of tangency, the draftsman will, with the aid of his T and set square, as explained in Art. 107, draw lines through the centers C and H, perpendicular to the tangent line; the points in which these lines cut the tangent are the points of tangency.

If the tangent is to be drawn on the floor, and the points of tangency are to be exactly located, it will generally be best to follow the construction shown in Fig. 113.

150. If the circles in Fig. 113 represent two pulleys, and it is required to find the exact length of belt to go around these pulleys, it will be necessary to find the points of tangency B, E, A and G; the distance between the points B and E, and also that between the points A and G will represent the amount of straight belt; and the arcs $B\,D\,A$, and the arc $E\,F\,G$, will represent the amount of curved belt; and these lengths can easily be obtained, either by measurement, or by calculation.

Problem 18.

151. TO DRAW A STRAIGHT LINE WHICH SHALL BE TANGENT TO TWO GIVEN CIRCLES, WITH THE POINTS OF TANGENCY LYING UPON OPPOSITE SIDES OF THE LINE JOINING THE CENTERS OF THE GIVEN CIRCLES.

Fig. 114. Let $C\,D\,E$ and $F\,G\,H$ be the two given circles; it is required to draw a tangent whose points of contact shall lie upon the opposite sides of the line $A\,B$. Under these conditions, two tangents to same circles can be drawn. Let us first draw the tangent $E\,F$.

Join the center A and B of the given circles, by a straight line; produce the same towards M, and intersecting the given circle in the point D. From D as a center, and with a radius equal to the radius of the circle $H\,G\,F$, describe a short arc, cutting the line $B\,M$ in the point M; then will $A\,M$ be equal to the sum of the two radii $B\,G$ and $A\,D$. From the center A, and with the radius $A\,M$, describe the circle $M\,N\,O$. Bisect the line $A\,B$ at the point K; from the point K as a center and with $K\,A$ as a radius describe the circle $A\,L\,B$ intersecting the circle $M\,N\,O$ in the joint I. Through the points I and B draw a straight line, also join the center A and the point I by a straight line intersecting the circle $C\,D\,E$ in the point E. Through the center B draw a straight line perpendicular to the line $I\,B$ and intersecting the circumference $F\,G\,H$ in the point F. Through the points E and F draw a straight line; then the line $E\,F$ will be the tangent required, and the points E and F will be the points of contact. In a similar manner the tangent $C\,H$ can be drawn.

The line $I\,B$ is tangent to the circle $N\,M\,O$, Art. 108, and the same line is also perpendicular to the line $A\,I$, Arts. 145 and 108. Since the line $F\,B$ is perpendicular to the line $I\,B$, and the line $F\,B$ has been drawn through the point of contact F, it follows that the line $E\,F$ drawn perpendicular to $F\,B$ is tangent to the circle $F\,G\,H$ and is also parallel to the line $I\,B$. But the line $I\,E$ is equal to the line $F\,B$, and these two lines are also parallel because they are perpendicular to the same line $I\,B$ therefore the line $E\,F$ must also be tangent to the circle $C\,D\,E$.

Directions.—In the space marked Problem 19 draw any two circles, one larger than the other, and draw a line tangent to these circles as explained in this article.

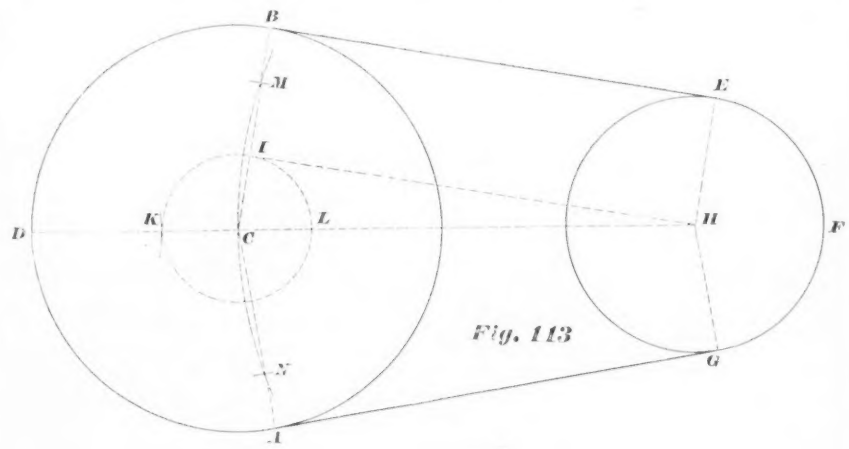


Fig. 113

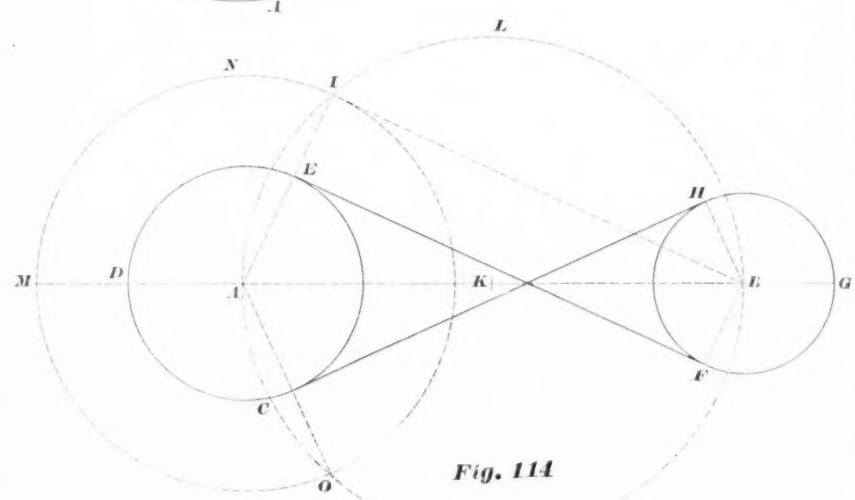


Fig. 114

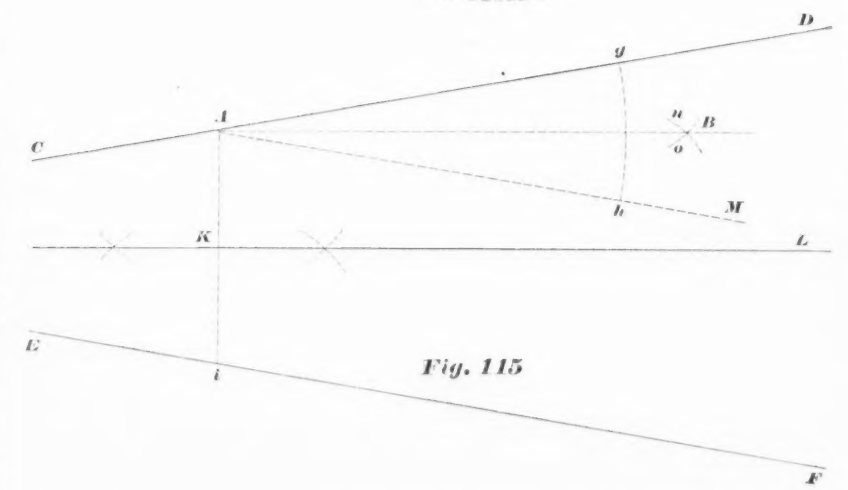


Fig. 115

Draftsman's Method.—The draftsman will simply place the T-square in a position in which the edge of the T-square will touch each of the given circles in one point, and then draw the tangent line along the edge of the square. If it is necessary to find the exact position of the points of contact, the draftsman will, with the aid of his T and set squares, as explained in Art. 107 draw straight lines through the centers A and B of the given circles perpendicular to the tangent line, the points in which these lines cut the tangent will be the points of contact.

Problem 19.

152. TO DRAW A STRAIGHT LINE WHICH SHALL BISECT THE INCLINATION OF TWO GIVEN LINES WHEN THE POINT OF INTERSECTION OF THESE TWO LINES IS INACCESSIBLE.

Fig. 115. Let the lines $C\,D$ and $E\,F$ be the given lines; it is required to draw a line $K\,L$ which shall bisect the inclination of the lines $C\,D$ and $E\,F$.

If it were possible to produce the lines $C\,D$ and $E\,F$ so that they would meet, we would simply bisect the angle formed by these lines as explained in Art. 112. But according to the conditions given in this problem the lines $C\,D$ and $E\,F$ cannot be produced, hence the following construction: On the line $E\,D$ take any point A, and through this point draw $A\,M$ parallel to the line $E\,F$, according to the instructions given in Art. 113. From point A, as a center and with any radius, describe an arc cutting the line $C\,D$ in the point g and the line $A\,M$ in the point h; from the point g, as a center and with a radius greater than half the distance between the points g and h, describe an arc o; and from the point h, as a center and with the same radius, describe the arc n cutting the arc o in the point B; through the points A and B draw the straight line $A\,B$; this line will bisect the angle $g\,A\,h$. Compare this construction with Art. 112. Through the point A draw a straight line perpendicular to $A\,B$, and cutting the line $E\,F$ in the point i. Bisect the line $A\,i$ at the point K by the method given in Art. 110. Through the point K draw a straight line $K\,L$ parallel to $A\,B$, then the line $K\,L$ will bisect the inclination of the lines $C\,D$ and $E\,F$.

Directions.—In the space marked Problem 20 draw any two straight lines, not parallel, then bisect their inclination as explained in this article.

Draftsman's Method.—When the inclination of two lines is to be bisected, and these lines are drawn a considerable distance apart on the floor, then the draftsman will adopt the method here given, or by some other similar method. When the given lines are drawn on paper the draftsman will find by trial the center of a circle which will be tangent to the given lines near their ends C and E, also in the same manner he will find the center of a circle tangent to the same lines near their ends D and F. Through these centers he will draw a straight line, and this line will bisect the inclination of the given lines.

Endowment for Technical Schools.

President Walker, of the Massachusetts Institute of Technology, in his yearly report forcibly refers to the lack of sufficient endowment to meet the growing demands incident to the greatly increased number of students, and the necessity for adding to the scope of the institute. This brings up the question of why it is apparently so much easier to find benevolently inclined people willing to endow a college pure and simple, than to find those willing to help technical institutions. Our institutions of learning are almost invariably far from being self-supporting, except as they are helped to that position by benefactions, and when the utilitarian character of technical schools is considered, it would seem that help would be more likely to flow to them than in any similar direction. Certainly the time has passed when objection to utilizing education found adherents.

There is a noticeable instance of neglect to help along the matter of useful education in the case of the Cooper Institute, in New York. Peter Cooper, while alive, devoted his time and money to building up and maintaining this school, and we doubt if money and time were ever spent to better purpose. But much as he did there is room to almost any extent in which to expand and enlarge upon his work. It has time and again been set forth that with more means this school could double and treble the good work it is doing, but no one seems inclined to furnish the means.

In such schools as the Massachusetts Institute of Technology it is not to be expected that the tuition of students will pay the expenses of keeping up the school upon such a plan as is desirable. The salaries paid instructors is almost invariably small; nothing can or should be saved in this direction. On the contrary there is always urgent need for increasing expenses in the way of salaries. There are but few schools of this kind—too few—in the country. If they are to do the work they ought to do they must have help. We trust President Walker's plain presentation will have the effect to call fruitful attention to the subject.

One of the subjects for discussion at the next meeting of the Western Railway Club, 175 Dearborn street, Chicago, is the weight of driving wheels and tires. It is to be introduced by Mr. C. E. Smart who believes that a large proportion of the rapid wear of driving wheel tires and rails, is due to abrasion caused by the ponderous rigid weight of driving wheels and tires. He favors reducing the weight of driving wheels and tires and transferring it, if necessary, to the boiler or frames where springs would intervene to soften its shock. Facts bearing on this subject are scarce. Any one having information about it, who cannot attend the meeting, January 19, would confer a favor on the club by communicating the same in writing to the Secretary, Angus Sinclair, at the above address.

The most practicable knowledge that was had of the value of compounding the steam engine came through the use of that system on steamships. Now it looks as if the advantages of triple expansion engines would come in the same way. Years after compounding had been tried in land engines it was taken up for steam navigation, and it has proved its entire success there. But it looks now as if the triple expansion engine is to be the motor of the future for ocean steamships. There are even now prominent engineers who believe that large factory engines will soon be quite extensively triple expansion.

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NEW YORK, JANUARY 22, 1887.

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The Inter-State Commerce Bill.

For many years there have been loud public complaints against unjust discriminations and exactions by railroads and transportation companies. Bills have been introduced in Congress to abate these evils, about the existence of which there is no doubt, but railroad companies have fought the measures with all their power. Until the present session no anti-discrimination bill has progressed further than to pass one branch of Congress. At last legislation is likely to be had upon this important subject. A bill passed by the Senate has been revised by a Conference Committee of the two houses, and present indications point to its becoming a law. By courtesy of Congressman T. A. Merriman, of this city, we have a copy of the revised bill before us. Its provisions apply to all common carriers, either by land or water, whose lines extend from one State or Territory into another, or into a foreign country. Lines wholly within a single State are not affected by it. The act creates the "Inter-State Commerce Commission," to be composed of five Commissioners appointed by the President, not more than three to be of the same political party. Nobody in the employ of any common carrier or "in any manner pecuniarily interested therein" can be a Commissioner. The Commissioners are each to be paid $7,500 a year, and cannot engage in any other business. Their headquarters shall be in Washington, and they are to have authority to "inquire into the management of the business of all common carriers," to require "a complete exhibit of the financial operations of the carrier each year," also a statement of the amount of cash paid in for stock, bonds and other purposes, and what everything has cost, including salaries paid to each class of employes, and what debts are owed. They can require "from such carriers specific answers to all questions, upon which the Commission may need information." The Commission makes annual reports to the Secretary of the Interior.

The bill prohibits the pooling of freights of competing railroads, but not the pooling of passenger receipts, nor does this provision apply to water lines. It requires every common carrier to print freight and passenger rates in force, and display in every depot or station, also furnish copies to the Commission. All the rules and regulations that affect those rates shall likewise be published. No advance in rates shall be made until after ten days' notice, but a reduction can be made at once by printing and posting new schedules. No person shall be charged a greater or a less rate than those published for any service in connection with transportation. Schedules of joint rates agreed upon with other roads or lines for exchange of freight and passengers must also be furnished to the Commission, which determines how much shall be made public. One section of the bill declares that all charges for transportation "shall be reasonable and just," and unreasonable and unjust charges are "prohibited and declared to be unlawful." What the practical effect of this provision would be is not apparent. Astute lawyers will probably have a chance to wrangle over it.

No "unreasonable preference or advantage" shall be given to any person or locality in the use of facilities afforded by common carriers, and nobody shall be subject "to any undue or unreasonable prejudice or disadvantage" in regard to any particular description of traffic. Equal facilities shall be accorded to all for the interchange of traffic between respective lines. Section 4 provides "that it shall be unlawful for any common carrier, subject to the provisions of this act, to charge or receive any greater compensation in the aggregate for the transportation of passengers, or of like kind of property, under substantially similar circumstances and conditions, for a shorter than for a longer distance over the same line, in the same direction, the shorter being included within the longer distance; but this shall not be construed as authorizing any common carrier within the terms of this act to charge and receive as great compensation for a shorter as for a longer distance—provided, however, that, upon application to the commission appointed under the provisions of this act, such common carrier may, in special cases, after investigation by the commission, be authorized to charge less for longer than for shorter distances for the transportation of passengers or property; and the commission may, from time to time, prescribe the extent to which such designated common carrier may be relieved from the operation of this section of this act."

It will be seen that the powers of the commission are pretty large.

The bill makes it "unlawful" for any common carrier to violate any of its requirements, either actively, or by neglect to do what is demanded. Any director, receiver, agent, etc., of a common carrier who violates this act shall be subject to a fine of $5,000. The duty of the commission, in case any provision of the law is violated, is to bring the case, "in a summary way," by petition to the Circuit Court of the United States, in the district where the offense is committed.

Any person, corporation or association can complain to the commission of a violation of the act, and the commission must notify the common carrier against whom complaint is made, and fully investigate, unless the remedy is promptly applied. The findings of the commission form "*prima facie* evidence" in court.

If the provisions of this bill were to be properly enforced, the public would derive great benefit; but their enforcement rests mainly with the five men who shall be named as commissioners. They are given power directly to make the provision in regard to long and short hauls, a nullity.

The commission can be constituted immediately after the passage of the bill; but its other provisions go into effect sixty days after its passage.

Encouraging Importations of Machinery.

The State Department at Washington publishes a monthly magazine made up of U. S. consular reports. It is printed at the Government Printing Office, and the title page declares that it is "published by the Department of State, according to act of Congress." In times past much useful information regarding the commerce, manufactures and labor of foreign countries has been embodied in these consular reports, and disseminated through the magazine. The reports are made in answer to circular letters of inquiry sent out by the Department to all U. S. Consuls. Lately this information is made to include some very conspicuous advertising of foreign manufacturers who have been selling their products in this country in competition with the same class of articles made here. The most recent number of the magazine we have received is that dated November, 1886. Consul Malmros, at Leith, Scotland, occupies seven pages in describing operation, products and equipment of two Scotch woolen mills. Five British manufacturers of textile machinery are given considerable advertising in that space. We cannot say whether this was accorded them out of pure generosity or desire to help manufacturers of textile fabrics in this country by showing them what excellent machinery they can buy abroad, or out of resentment towards the makers of textile machinery in the United States because of their perversity in trying to monopolize American markets, under a protective tariff, to the exclusion of the wonderfully cheap and serviceable machinery made in Britain. In the report of Consul Malmros one firm making looms is mentioned no less than seven times, always with the address. Perhaps therefore we should not think it strange when he says they "make the best loom for the Scotch trade" and that they may be had for a specified amount in dollars and cents for each loom. The next best loom makers are also mentioned. In closing the description of the first woolen mill the Consul says: "I subjoin herewith description, diagram and price list of McNaught's new patent wool washing machine used in this mill." Then follows a full page engraving of the machine with the mark of a New York engraver. The price list and description do not appear, but perhaps are reserved for a future issue. On one page a foot note is placed to remind the reader that an illustration of a carding engine mentioned will be found in the August, 1886, number of the magazine.

In arranging the matter in the magazine it is but reasonable to suppose that what is desired to appear prominent is given the first place. We find the report of Consul Malmros placed the first in the November issue. Can it be that our State Department is using the public service to encourage the importation of foreign machinery? It looks so. If the indications we have pointed out are not correct, advertising of the kind we mention will not continue to appear, either as the most conspicuous matter in the magazine, or as the least conspicuous.

Textile machinery is the only kind of machinery now imported into this country to any important extent. We can get along very well without it, as textile machinery is made here that is not excelled in any part of world.

When the Railroad Commission of the State of New York was constituted by law Governor Cleveland was asked by the Legislature to appoint one of the three Commissioners from names presented to him by the Anti-Monopoly League and the trades and labor assembles of the State. He did so, and popular approval of the result has never been shaken. When the Inter-State Railroad Commission of the United States shall be constituted by law President Cleveland should be asked by Congress to appoint one of the five Commissioners from names presented to him by the labor unions, farmers' alliances and trades assemblies of the whole country. If organized labor is entitled to one of three railroad commissioners of a State, much more is it entitled to one of five national railroad commissioners.

Literary Notes.

The *Way Bill* of this city celebrates the completion of its first year by issuing a neat Christmas number. It presents portraits and sketches of the career of over thirty representative railroad men of New York city.

The holiday number of the *Northwestern Miller*, of Minneapolis, is a large beautifully printed issue of a hundred pages. It is replete with original stories, sketches, poems, portraits of men interested in the milling industry and a variety of other engravings. Several prominent authors have contributed to this interesting number.

The *Saw-Mill Gazette* is a live monthly devoted to wood working interests, published by M. J. Richardson, 27 New Chambers street, New York. Mr. Richardson offers some cash prizes for the best articles on "How to Manage a Steam Engine" and "How to Repair Steam Engines." Full particulars as to the competition will be sent to those asking for them.

The holiday number of the *Illustrated News*, of Cincinnati, is a superb specimen of the engravers and printers' arts. A birds-eye view of New York city, size of eight pages, and one of Cincinnati a little smaller, are included in this number. Altogether it is much superior to the monotonous Christmas numbers of the principal London illustrated papers that in previous years have sold so largely in this country.

"The World's Exchanges" is the title of a large lithographed poster, showing views of the stock exchanges in London, Paris, New York, Berlin, and other financial centers. The work, which reflects much credit both as to artistic and mechanical execution, emanates from the firm of Root & Tinker, *Tribune* Building, and the engraving is sent us by courtesy of Moore & Schley, Bankers and Brokers, New York.

The *National Labor Tribune*, of Pittsburgh, comes out with its January 1 issue in a new dress of type and a new design of heading, which greatly improves its appearance. The *Labor Tribune* is in its fifteenth year, and is the best representative of organized labor interests of any newspaper in this country. Published weekly at $2.00 per year.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(16) F. H. K., Cleveland, Ohio, will find description of the black process of copying drawings in the AMERICAN MACHINIST of April 19, 1884, and July 19, 1884. We do not recommend any book as the "best."

(17) S. D., Passaic, N. J., will find an article on the subject of pressure on slide valves in the AMERICAN MACHINIST of June 2, 1883. From this it will be seen that much more data than he furnishes are required.

(18) J. M., New York, asks: 1. Are the working tools of a young man already in this country subject to duty if sent for, they having been used? *A.*—Duty will undoubtedly be charged, but an explanation of what they are will probably relieve you from payment. 2. What is the duty on finished machinery? *A.*—45 per cent.

(19) C. C. G. asks: 1. Can a blue print of an ordinary letter be made plain enough so that it can be read easily? *A.*—Yes, providing the letter paper is not too thick and the ink black. 2. What is the cost of an outfit to make the usual size of blue prints? *A.*—An outfit for making blue prints twice the size of the AMERICAN MACHINIST page will cost about $4.

(20) A. A. K., Bethany, Mo., writes: It is claimed that a well-proportioned hollow column, 6-inch diameter, will bear a greater crushing strain than a solid column of the same diameter. Is this right? *A.*—On general principles, the solid column is the strongest. It might be possible in some cases to improve the solidity of the iron by casting on a small core, so that the hollow column would be the strongest. If you take the solid column and drill out the center, it will certainly be weaker.

(21) C. H., Jackson, Mich., asks: How can I mark a name on steel by using acid? *A.*—Mix six parts of nitric acid with one part muriatic acid; this is the etching fluid. Warm the steel, and cover it with a thin coat of beeswax. Write on this with a sharp-pointed instrument, taking care that it cuts quite through the wax to the steel then with a brush or feather apply the fluid, filling each letter or mark. In about five minutes, more or less, according to the depth required, pour on water, which will stop the eating of the fluid.

(22) G. G., Beaufort, S. C., asks: Do you know of any paper devoted exclusively to foundry interests? *A.*—There is no such paper published. The AMERICAN MACHINIST has published more of interest, in a practical way, to foundrymen than any other paper in the world, and will endeavor to continue to do so in the future. If you want to know anything special in this branch of mechanics, send your queries to us. We have as special writers on these subjects some of the best practical foundrymen in the world, to whom we shall be pleased to refer your questions.

(23) W. N. F., Philadelphia, Pa., asks: 1. Is there any method of bluing steel other than heating? *A.*—There is no other satisfactory way. You can color it with some blue pigment, as Prussian blue, but it will not amount to much. 2. How can I make a blue lacquer to heighten the color of blued steel? *A.*—We do not know of any. 3. What is the best method of tinning cast iron? *A.*—One way is, clean the articles, and put in a bath of one ounce cream of tartar, one ounce tin salt, and ten quarts of water. The bath should be kept at a temperature of 190° in a stoneware vessel. Put pieces of zinc between the articles.

(24) G. D. D., Canada, asks: 1. What is the best way to solder the end of the rib on a double-barreled gun that has become loose? *A.*—The best way is to take it to a gunsmith who understands such work. 2. How are pieces of cast iron that are to be used for patterns pickled? *A.*—By being immersed in a solution of one part of oil of vitriol to seven or eight parts of water. 3. Does pickling soften the iron or the scale on it? *A.*—In pickling rough castings, the pickle attacks the iron, and thus loosens the scale. It does not soften the iron. 4. Do you know of any practical way of softening the hard scale on cast iron? *A.*—No.

(25) G., Mount Morris, N. Y., asks: 1. If the fly-wheel of an engine weighs 6,500 pounds, and the breadth of face is 25 inches, what should be its thickness? *A.*—You do not give the diameter of wheel. You can calculate the weight of rim by calculating the number of cubic inches in it, then multiplying by .26. 2. Which makes the best setting for an automatic engine, stone well cemented, or hard-burned brick? *A.*—There is nothing quite equal to large, smooth stone; hard-burned brick, however, makes a good foundation. 3. In return tubular boilers about what per cent. of saving is made by returning the products of combustion over the top of the boiler? *A.*—Nothing. 4. Is it advisable to set an engine foundation on plank when there is water on the bottom of pit? *A.*—No. Use large stone at the bottom, laid in hydraulic cement.

(26) J. O. writes: Scientific authorities tell us that if we have two surfaces in contact, one of them moving upon the other (as for instance, the surfaces of the locomotive driving wheel and the rail), the coefficient of friction cannot be increased by increasing the velocity of the surfaces. If this is the case, why is it that runners always put on steam when they find that their driving wheels are slipping? *A.*—Competent locomotive engineers will never put on steam when the driving wheels are slipping. If you will watch them carefully, you will find that in starting the engineer opens the throttle valve very cautiously, and, as the speed of train increases, the throttle is slowly opened wider. Sometimes the engineer opens the throttle too fast, and thus will cause the driving wheels to slip, but will not allow them to do so for any length of time.

(27) J. M. C. writes: I have an engine, cylinder 26″x42″; piston travel, 560 feet per minute; steam pressure, 70 lbs. It is a Corliss cylinder. I want to bore it out so as to put in a different piston. What thickness of iron in cylinder would be the limit of safety? It is now 1⅜″ at counter bore and 1¼″ piston bore. How can I find the length of one side of a triangle (acute) when the length of the others are given, and the three angles known, without referring to a table of sines and cosines? Mention some reliable works on trigonometry. *A.*—1. In the AMERICAN MACHINIST of August 22d, 1885, page 2, you will find an article on the thickness of metal in cylinders. Adopting the rule there given, namely:

$$\left(\text{Diam. of cyl. in inches} \times \text{steam pressure per square inch} \times .0001\right) + .15\sqrt{\text{Diam. of cyl. in inches.}}$$

= thickness of metal in cylinder. Hence $(26 \times 70 \times .0001) + .15\sqrt{26} = .947$ of an inch; say, 1 inch for the thickness of cylinder. We believe that ⅞ of an inch will be the limit of safety for the thickness of metal. 2. You will find the rules for calculating the sides of an acute-angled triangle in Davies' Legendre, or Loomis's Geometry.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

J. Clayton, Air Compressors, Rock Drills, 43 Dey st, NY

Edw. Sears, Wood Engraver, 169 William st., N.Y.

Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.

N. B. Non-breakable Drills and Taps. A. P. Brown, 108 Liberty st., N. Y.

Solid Nickel-Seated "Pop" Safety Valves. Consolidated Safety Valve Co., 111 Liberty st., N. Y.

The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.

Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., NY

Davis Key-Seating Machines, kept in stock, by Manning, Maxwell & Moore, 111 Liberty st., N. Y.

Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 93 John st., N. Y.

20,000 addresses of steam users and users of mach. in 10 States, $10. J. N. Mills Pub. Co., 30 Vesey st., N. Y.

20″, 25,″ 28″ B G. and S. F. upright drills for immediate delivery. Currier & Snyder, Worcester, Mass.

Ice and Refrigerating Machines. 120 built, and all successful, by David Boyle, 521 Monroe, Chicago, Ill.

The Improved Tabor Steam Engine Indicator, made and sold by The Ashcroft Mfg. Co. 111 Liberty st., N. Y.

Engine Lathes, Hand Lathes, and other fine tools, Assortment large; prices low. Frasse & Co., 92 Park row, N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

Curtis Pressure Regulators, Curtis Return Trap. Curtis Damper Regulator. See Jan 8, p. 11. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.

Machinists' supplies, brass goods m'f'rs supplies, polishing materials, all kinds wire, metals, etc; in any quantity. Jordan & Gottfried, 208 Canal st., N.Y.

Handbook on the Care of Boilers. 50c. Descriptive Circular and Catalogue of Books for Mechanical Engineers free on application; special terms to Mechanics' Libraries. E. & F. N. Spon, Publishers, 35 Murray st., New York.

St. John Improved Self-adjusting Cylinder Packing, for marine and stationary engines and locomotives; applicable to water, air, oil and ammonia pumps. For durability and minimum of friction, it is unexcelled. Send for pamphlet. Address, Balance Valve and Piston Packing Co., room 58, 280 Broadway, New York.

Patent Binders for the AMERICAN MACHINIST, holding a complete volume (52 issues), simple, neat, durable. Price, $1, prepaid, to any part of the United States by mail. To Canada or foreign countries the price will be 75c.; purchasers pay express charges and customs duties. AM. MACHINIST PUB'G CO., 96 Fulton st., N. Y.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price, $2 post-paid. Published by John Wiley & Sons, 15 Astor Place, New York.

MANUFACTURES

The St. Paul and Duluth Railroad will build new shops at St. Paul in the spring.

The Remington Machine Company, Wilmington, Del., will erect a brass foundry.

J. J. & J. Leonard, Dalton, O., are erecting an addition to their stove foundry.

Blossoms & Merrill, St. Paul, Minn., will erect a $25,000 sash, door and blind factory.

V. H Beerman will erect a $30,000 store and factory at Frankfort and Pearl streets, New York.

A new cotton factory will be erected in Athens, Ala. John L. Tanner, of that place, is interested.

Knebel & Co., of Pierron, Ill., contemplate establishing a new factory for extracting oil from cotton seed.

Edwin A. Merritt, Jr., of Potsdam, N. Y., contemplates the erection of a paper mill at Hannawa Falls.

The Universal Radial Drill Company, of Cincinnati, has lately sent a No. 3 drill to the Brooklyn Navy Yard.

The Ansonia Brass and Copper Company, Ansonia, Conn., is building a brick shop, 80x200, for rolling copper.

It is reported that parties from Minneapolis, Minn., have secured ore lands at Isbell, Ala., and will erect a blast furnace.

It is probable that a company with a large capital will be formed at Nashville, Tenn., to start a manufacturing town near that city.

It is reported that the machine shops of the St. Louis, Iron Mountain and Southern Railroad, at Little Rock, Ark., are to be enlarged.

George W. Dudley, Moses Bros. and others are forming a company to build stove works at Montgomery, Ala. The capital stock will be $50,000.

William C. Harris, of Mercer, Pa., has been awarded the contract of erecting the buildings for the Tin Plate Works, to be erected at Hubbard, O.

C. E. Graham, Richmond Pearson and others are forming a company to build a cotton factory at Asheville, N. C. The capacity is to be 250 looms.

The Mechanical, Manufacturing and Agricultural Association has been formed at Thibodeaux, La., to organize some kind of manufacturing industry.

The business men of Pemberton, N. J., have organized a Board of Trade, and subscribed $2,000 for the purpose of inducing manufacturers to settle there.

The Brown & Sharpe Manufacturing Company, Providence, R. I., have increased their force to 625 men, and the prospects are favorable for another increase soon.

A recent special election in Americus, Ga., went in favor of public water-works. It is proposed now to have public gas-works. Americus is a lively progressive town.

The Manchester Locomotive Works, Manchester, N. H., are about to increase their working force from 300 to 500. They have orders that will keep them busy until July.

The Hersh Heater Company will not pay taxes at Lehighton, Pa., for ten years—an inducement held forth by the Council of that borough to have the corporation locate there.

The Chicago, Rock Island and Pacific Railway has been offered twenty acres of land in Rock Island, on which to locate shops. The main shops of this road are in Chicago.

The Pratt & Whitney Company, of Hartford, Conn., have purchased fifteen emery wheel tool-grinders from the Springfield Glue and Emery Wheel Company during the past season.

The works of the Co-operative Nail Company, at Steubenville, O., are offered for sale. These works were erected during the nail strike last year by a number of nail workers. They were in operation about three months.

The Morris woolen mill property at Catskill, N. Y., has been sold to Mr. Wiley, of Philmont, Columbia County, who will convert it into a knitting mill, and expects to employ upward of 300 hands. The price paid was $27,500.

Five locomotives that are in course of construction by the Rhode Island Locomotive Works for the Cincinnati, New Orleans and Texas road will have boiler and fire-boxes of steel made by the natural gas process at Pittsburgh, Pa.

A company is being organized at Beaufort, S. C., to construct water-works and artesian wells to supply the town with water. The incorporators are C. Townsend, W. T. Seward, Geo. Holmes and others.

The new Bessemer steel works at Wareham, Mass., will consist of a building 120x60 feet. In the steel works will be placed two three-ton Clapp-Griffiths converters, each capable of turning out nine to twelve tons an hour.

T. New Manufacturing Company has been incorporated, to make paving and roofing materials, on a capital of $200,000; shares, 2,000. Trustees are T. New, of Brooklyn, N. Y.; Edwin E. Dickinson, and Lewis W. Harrington, of New York.

The Bridgeport Forge Company, Bridgeport, Conn., have recently made an addition, 100x60 feet, to their hammer shop. This is the fourth addition which has been made in this department since their start in business but a few years since.

The Bridgeport Copper Company, Bridgeport, Conn., are adding to their plant a new building about 100x60 feet; they are also increasing their furnaces in the refining department by two more. This company will also probably build a new rolling mill.

The Baltimore *Manufacturers' Record* says: "The Southwestern Iron Works, Louisville, Ky., reported last week as incorporated by Alfred Bell and others, have erected a foundry, 60x100 feet, and a machine shop, 40x80 feet. The paid-up capital stock is $20,000."

The Silsby Manufacturing Company, Seneca Falls, N. Y., issue an illustrated catalogue of fire apparatus made by them. Their rotary fire engine has been in use for thirty years, and there are over 800 in service, which is claimed to be more than of any other make in the world

There is a prospect of a new cotton manufactory at Newport, N. H., to employ 100 hands. A Boston party is said to be at the head of the enterprise. A meeting of capitalists has been held, and a town meeting will probably be held to exempt the business from taxation for a term of years.

The Cambria Iron Company is reported to have recently issued a notice to its employes, telling them that in future they will allow the employes to take stock in the company's store, and that they will issue coupons to the buyers of their stock in order to enable them to have a share in it.—*American Manufacturer.*

E. H. Brownell & Co., Dayton, have recently taken orders for six 60″ by 16 feet boilers for parties in Sandusky, O., and one of same size for a company in Milwaukee. They are building a smoke-stack, on order, 72″ by 60 feet, an oil tank, and several Brownell heaters. Business is good and the outlook bright.

The New Howe Manufacturing Company, of Bridgeport, Conn., will occupy a portion of the now idle works of the Howe Sewing Machine Company. The company is composed of prominent capitalists, and will start up about January 15th, employing 200 men. They will make sewing machines and other machinery.

The Detroit Car and Wheel Manufacturing Company will commence business in April, giving employment to 1,000 hands. They occupy the old shops of the Peninsular Car Works, and have erected two new foundry buildings. The enterprise will represent an investment of $1,000,000. Hiram Walker & Sons are the managers.—*Railway Review.*

The Birmingham Furnace and Manufacturing Co., Birmingham, Ala., has recently organized, with $1,500,000 capital. They will build two hundred-ton blast furnaces near Birmingham. Robert Hogsett, of Uniontown, Pa., has been elected as president and general manager; J. M. Thompson, Uniontown, vice-president; U. Ewing, treasurer; and Robert D. Smith, secretary.

The Sloss Iron and Steel Company, Birmingham, Ala., previously reported as purchasing the entire property of the Sloss Furnace Company, proposes to build two additional 100-ton furnaces at once, and have them completed within fifteen months. Two hundred and fifty coke ovens and a steel plant will also be built. The company will issue $2,000,000 of bonds in addition to the capital stock of $3,000,000.

A citizens' committee to encourage manufacturing has been organized in Montpelier, Vt. They voted to start a paper requesting the selectmen to call a special town meeting to see if the town will exempt any new manufacturing interest from taxation for a period of ten years, and the executive committee were instructed to prepare a circular letter, setting forth the advantages of the Vermont capital to new-comers.—*Boston Commercial Bulletin.*

Prominent capitalists of Philadelphia are contemplating, in connection with the Fairmount Coal and Iron Company, an adjunct of the Buffalo, New York and Philadelphia Railroad Company, opening a mining and coke plant and a blast and steel furnace at Fairmount, Clarion County, Pa., on the low-grade division of the Allegheny Valley Railroad. The total investment in these is estimated at $255,000. The estimated cost of making a ton of iron at these works is $11.25. The production of iron per year is estimated at 26,250 tons. It is estimated that steel billets can be made by the company at a cost of $15.40 per ton. The production of billets per year is estimated at 22,662 tons. Natural gas abounds upon both sides of the grounds of the company, and will be used by them.—*American Manufacturer.*

Machinists' Supplies and Iron.

NEW YORK, Jan. 6, 1887

There is nothing new in manufacturing or supplies. Business in iron seems to work along smoothly, the consumption just about absorbing, without crowding, production. There is apparently but little inclination to contract ahead, nor are furnacemen anxious in this respect. American pig has sold as per following quotations: No. 1 X Foundry, Lehigh brands, $21 to $21.50; No. 2 X, $19 to $20; Grey Forge, $17.25 to $17.50.

Scotch Pig—While there is not large demands for Scotch brands, it is noticeable that prices are held firm. Some advances have been made in Glasgow, probably influenced by advances here in American brands. We quote Coltness, $22 to $22.50; Glengarnock, $21; Summerlee, $21 to $21.50; Eglington, $20.25; Langloan, $21.50 to $22; Dalmellington, $20.50.

Lead—The market for common pig is dull. A small amount has changed hands, at 4.15c.

Tin—There has been small advances in price, owing to a firmer tone in English markets. Jobbing lots of Banca have sold for 23c.; Straits and Malacca, 22 35c.

Copper—Lake, 11⅞c.; Arizona, 11c. to 11⅛c.

Antimony—Hallett's, 7⅝c.; Cookson's, 9c.

Spelter—Refined, 5¾c. to 6c.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate, 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

First-class toolmaker wanted. B. W. Payne & Sons, Elmira, N. Y.

Mechanical draftsman—12 years' experience on steam engines and special m'ch'y, wants situation in N. Y. or vicinity. Address "Skill," AM. MACH.

Draftsman—Thorough practical mechanic and designer desires engagement in growing Western town; permanent situation an object. Address Cleveland, AM. MACHINIST.

Draftsman wanted; must have had practical experience in machine design. Address, stating age, experience, references and compensation wanted, the Yale & Towne Mfg. Co., Stamford, Conn.

✢ MISCELLANEOUS WANTS. ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion.

Crescent Boiler Tube Expander; second to none, price in reach of all. Crescent Mfg. Co., Cleveland, O.

The Crescent Link Belt Coupling; something new; sample free. Crescent Mfg. Co., Cleveland, O.

Light mach'y of all kinds built at short notice Edmund Mills, 8 Dey st., Jersey City Heights, N. J.

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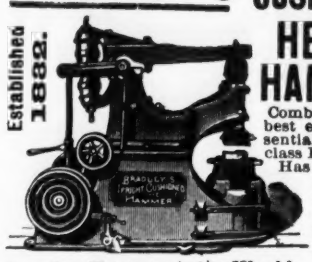

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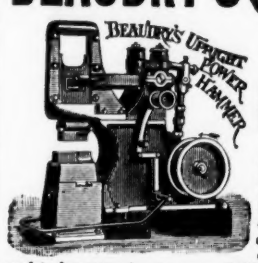

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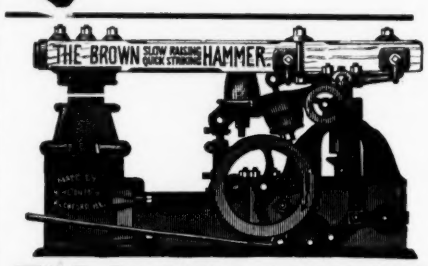

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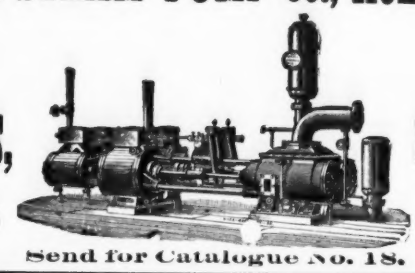

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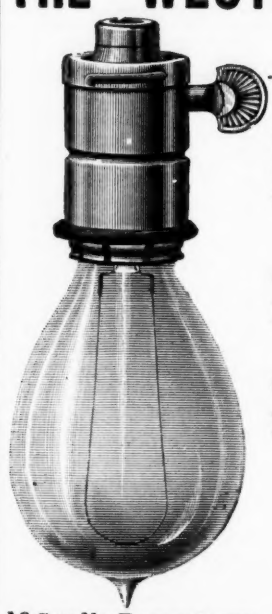

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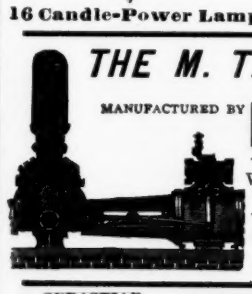

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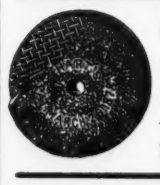

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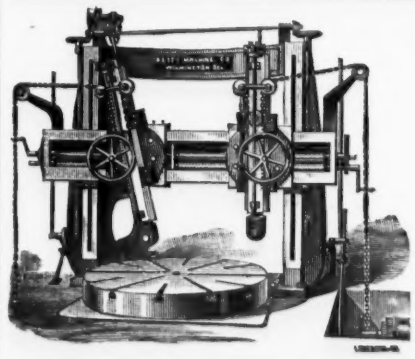

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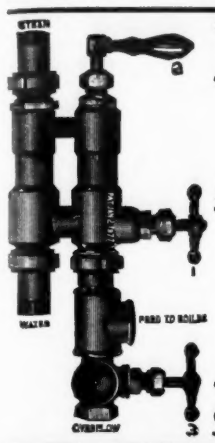

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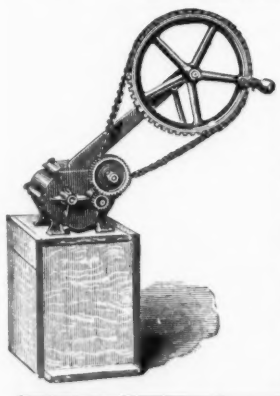

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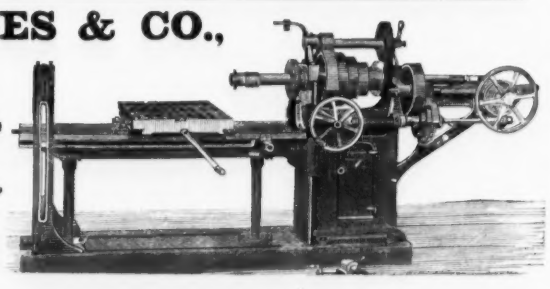

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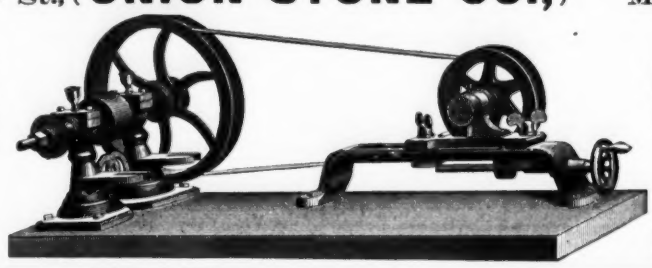

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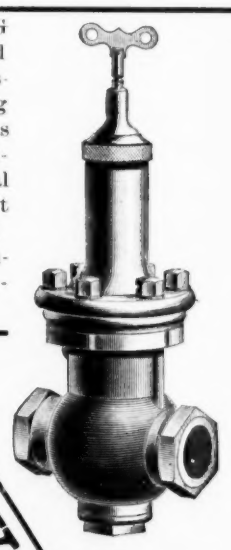

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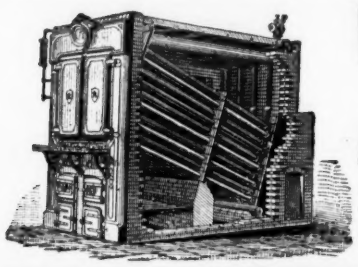

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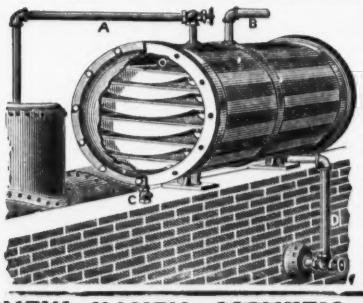

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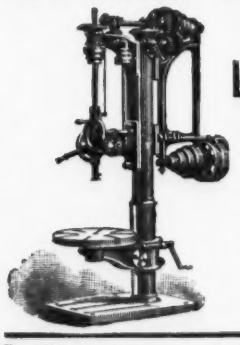

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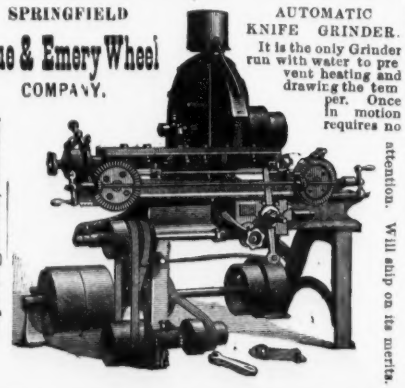

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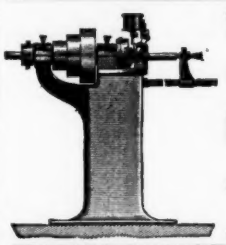

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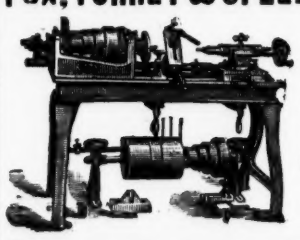

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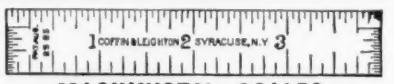

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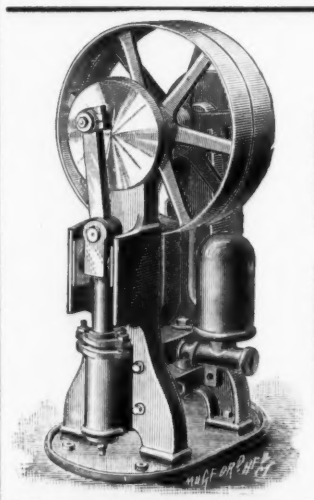

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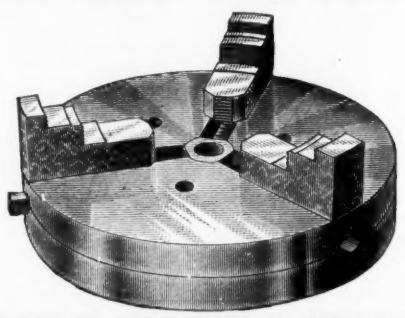

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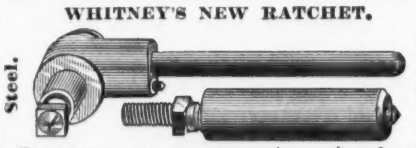

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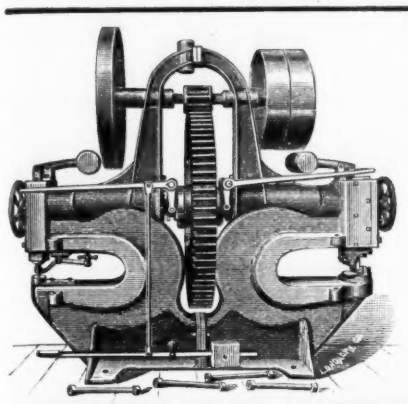

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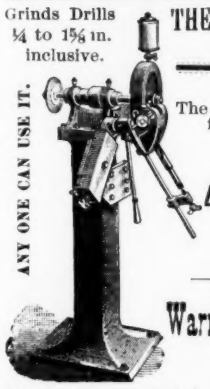

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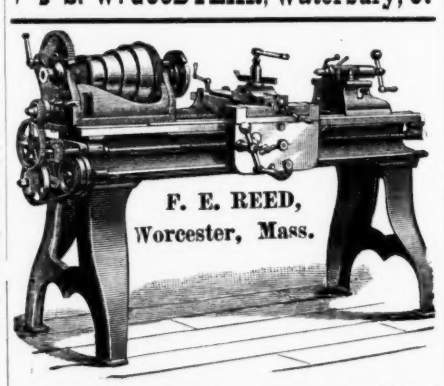

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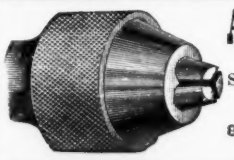

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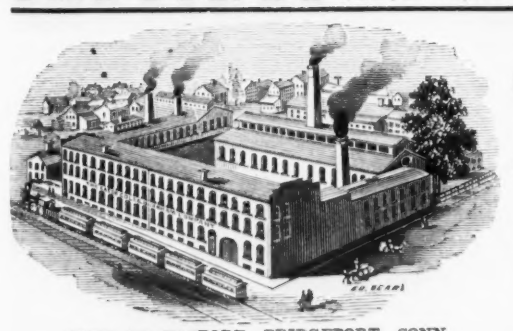

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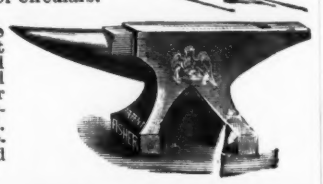

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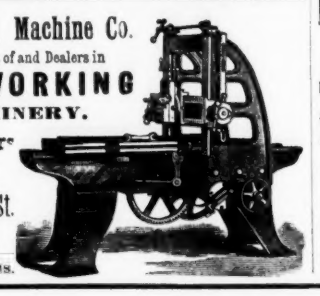

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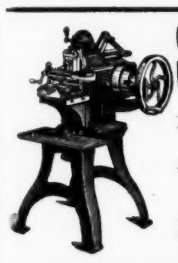

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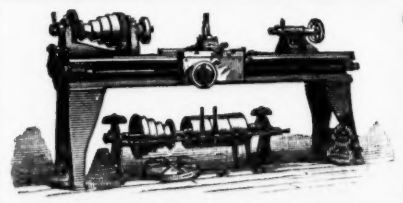

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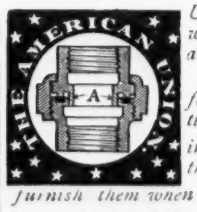

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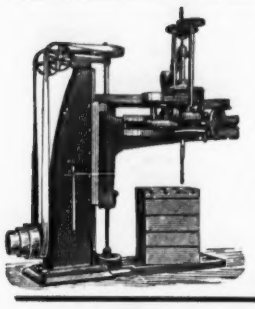

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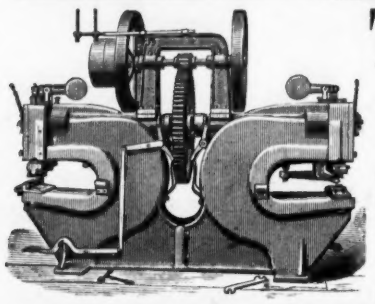

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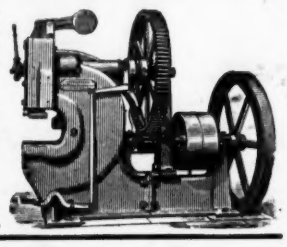

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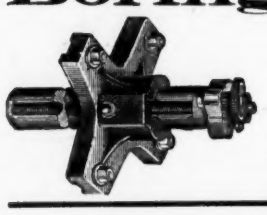

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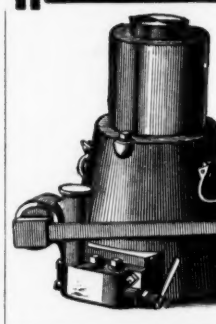

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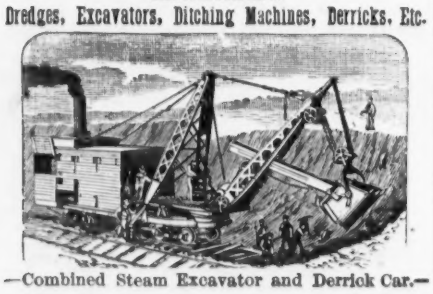

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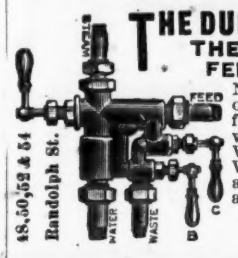

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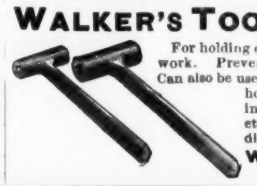

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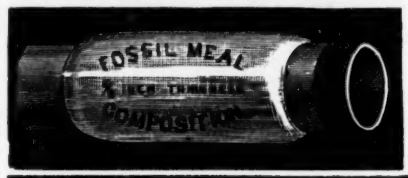

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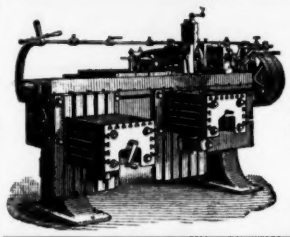

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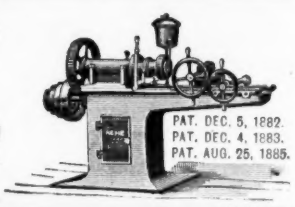

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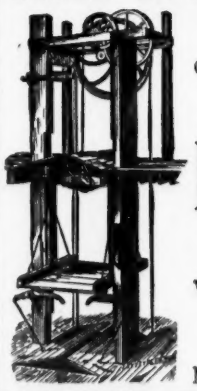

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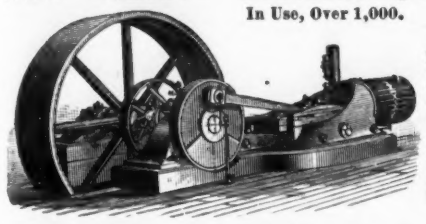

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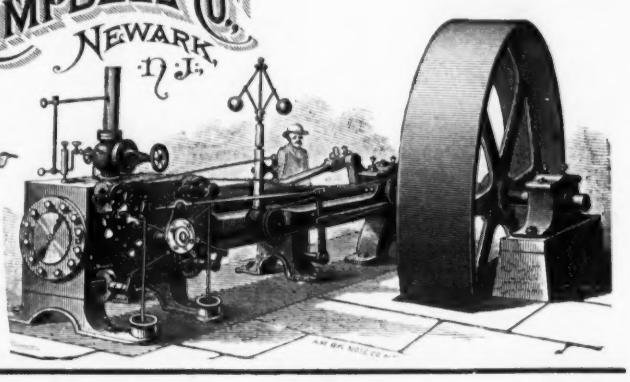

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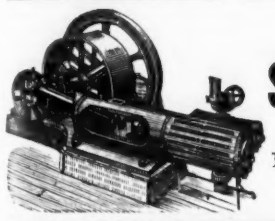

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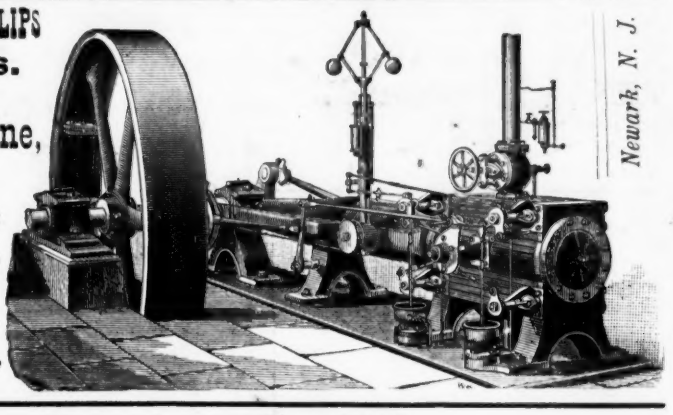

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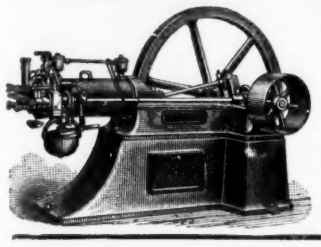

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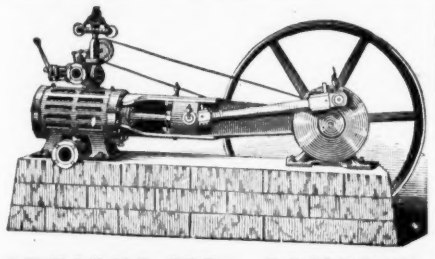

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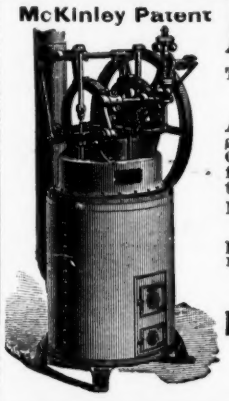

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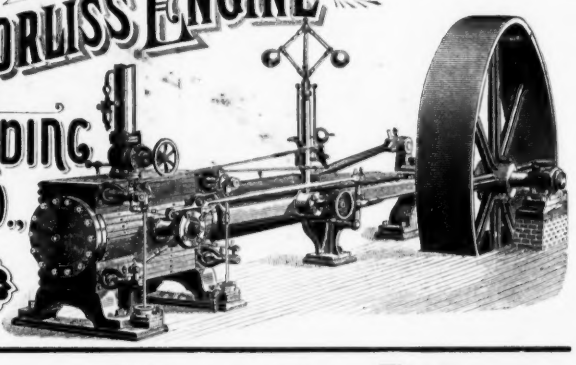

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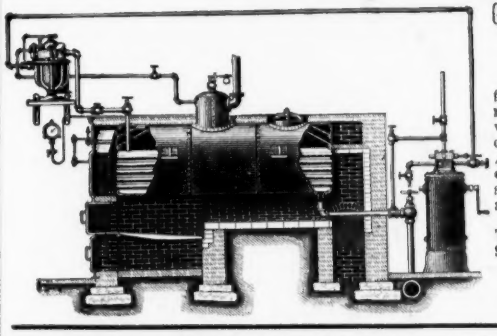

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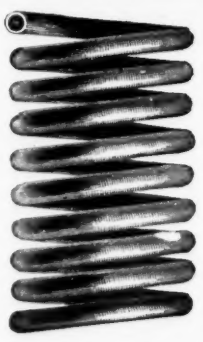

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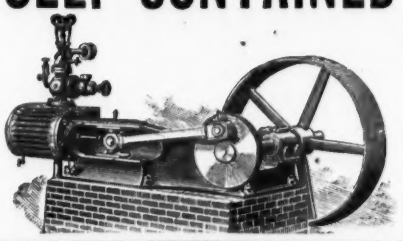

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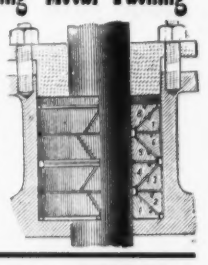

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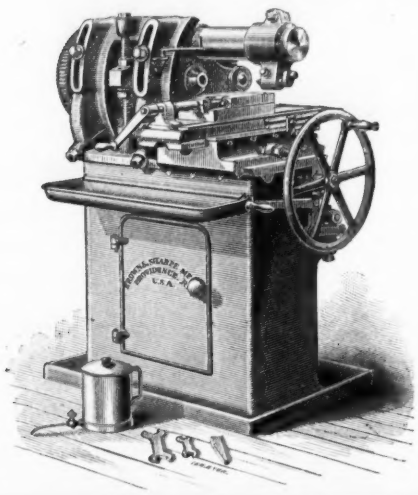

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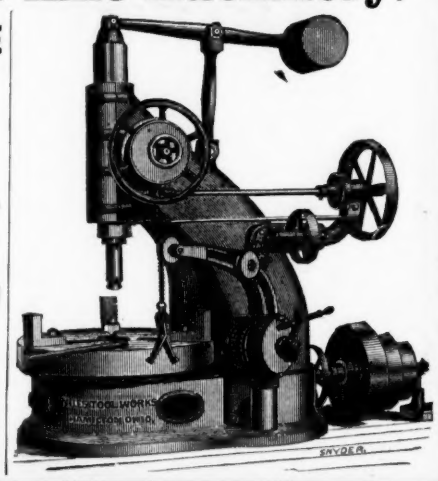

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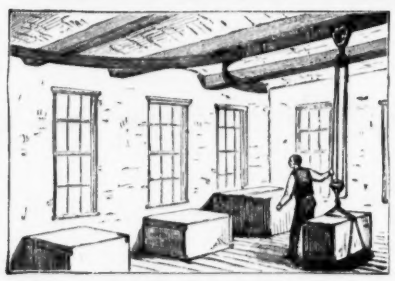

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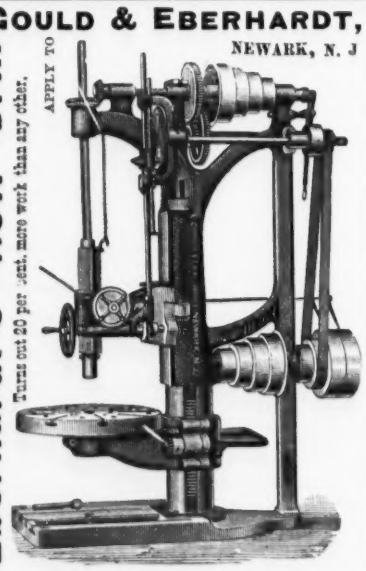

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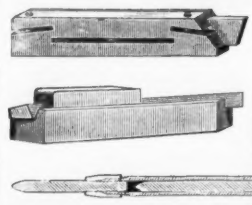

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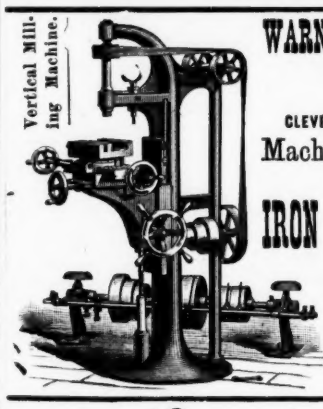

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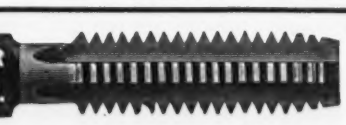

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